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INTRODUCTION TO APPENDICES

The following appendices are included in this report:

Appendix A - Description of Spiking Procedures

Appendix B - Sampling and Analytical Methods

Appendix C - Description of CEM System

Appendix D - Raw Operational Data Sheets

Appendix E - Hourly Averages for CEM System Data

Appendix F - Raw Analytical Data Sheets for Test Items

Appendix G - Analytical Data Summary Tables for Stack Test Program

Appendix H - Analytical Data Summary Tables for Test Items

Appendix I - Example Calculations

Breaker pages are provided to identify each appendix listed above. A brief summary is included at the beginning of each appendix describing the contents.



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APPENDIX A DESCRIPTION OF SPIKING PROCEDURES

A. Description of Spiking Procedures

A description of the spiking procedures is discussed in the following subsections. Sparkless equipment was used when preparing and applying the spike solutions. WESTON personnel, in conjunction with HWAAP laboratory personnel, prepared the liquid spike solutions. HWAAP laboratory personnel prepared the paste spike solutions. HWAAP laboratory personnel applied all spike liquid/paste solutions.

A.1 TNT spiking procedures. A homogenous liquid solution (i.e., no solid TNT) was used to spike the following items of equipment:

- o powder boxes
- o steam-heated risers
- o steam-heated discharge valves
- o steel pipe
- o aluminum pipe

Prior to spiking, a batch solution was made to spike all test equipment. One hundred grams of TNT were added to 250 mL of acetone; 25 mL of the homogenous solution were added to the test equipment outlined above (using a pipet). After adding the solution to the equipment, the pipet was flushed with acetonitrile to remove residual TNT. The rinsate was added to the equipment. This resulted in a spike of 10 grams of TNT for each piece of equipment.

The liquid spike solution was added directly into the powder boxes. The boxes were agitated to swirl the liquid, exposing it to the internal surfaces. Holes or cracks in the powder boxes were plugged with parafilm wax.

For steam-heated vessels (risers and discharge valves), the bottom steam connection was covered with parafilm wax. Although it was originally planned to use rubber stoppers, parafilm was used to avoid potential analytical interference associated with rubber products. The spike solution was added to the upper steam connection. The vessel was agitated to swirl the liquid and expose it to the internal surfaces.

For pipe (aluminum and steel), one end of the pipe section was covered with parafilm wax. Spike solution was added into the open end of the pipe. The pipe was agitated to swirl the liquid, exposing it to the internal surfaces.

A heterogenous mixture (i.e., a workable paste) was used to spike the support racks for shells. For the TNT spike, 1 gram of TNT was mixed with about 0.8 mL of acetone. Although it was originally planned to spike shell support racks with 10 grams of TNT, field operations indicated that 1 gram was sufficient to cover the spike area (4 inches by 4 inches) adequately. The mixing container and applicator (spatula) were rinsed with about

50 mL acetonitrile. The rinsate was collected for analysis to determine the amount of TNT that adhered to the container and applicator.

The spiked equipment was placed on the loading dock of Building 117-15 and allowed to air dry.

- A.2 Ammonium picrate spiking procedures. A homogenous liquid solution (i.e., no solid ammonium picrate) was used to spike the following items of equipment:
 - o powder box
 - o steam-heated riser
 - o steam-heated discharge valve
 - o steel pipe
 - o aluminum pipe

Prior to spiking, a batch solution was made to spike all test equipment. Forty grams of ammonium picrate were added to 2400 mL of acetone; 300 mL of the homogenous solution were added to the test equipment outlined above (using a pipet). After adding the solution to the equipment, the pipet was flushed with water to remove residual ammonium picrate. The rinsate was added to the equipment. This resulted in a spike of 5 grams of ammonium picrate for each piece of equipment.

The procedures for spiking with ammonium picrate are the same as those used for spiking with TNT (for each type of equipment).

A.3 Spike recovery procedures. As outlined in the Test Plan, it was originally planned to conduct spike recovery tests. Selected pieces of test equipment were to be spiked with TNT and ammonium picrate. The spiked equipment was to be sampled (wipe samples or rinsates) to determine the efficiency of the sampling methods. During spiking activities, however, it was determined that it would never be possible to fully recover the TNT or ammonium picrate spiked on the equipment. Residual levels of explosives on the parafilm, steam connections, etc. interfered with recovery. Therefo :, based on conversations with USATHAMA personnel, it was decided to conduct multiple rinses on the treated test equipment rather than on spiked equipment. Treated equipment was sampled using a series of four rinses.

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APPENDIX B SAMPLING AND ANALYTICAL METHODS

Appendix B provides a description of the following Sampling and Analytical Methods:

- EPA Method 1 Sample and velocity traverses for stationary sources. (Page B-1)
- EPA Method 2 Determination of stack gas velocity and volumetric flow rate. (Page B-5)
- EPA Method 25A Determination of total gaseous organic concentration using a flame ionization analyzer. (Page B-17)
- EPA Method 3 Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight. (Page B-19)
- EPA Method 10 Determination of carbon monoxide emissions from stationary sources. (Page B-21)
- EPA Method 4 Determination of moisture content in stack gases. (B-25)
- EPA Wipe Sampling Technique (Page B-29)
- Modified Method LW02 Analysis of explosives in soil, wipe, and rinsate samples. (Page B-33)
- Modified Method for nitrocellulose, nitroglycerin, and PETN in water. (Page B-45)
- Ammonium Picrate in water and wipe samples by high performance liquid chromatography. (Page B-49)
- EPA Modified Method 5 Modified method 5 sampling train. (Page B-55)
- EPA Method 5 Determination of particulate emissions from stationary sources. (Page B-105)
- EPA Method 3A Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources. (Page B-119)
- EPA Method 7E Determination of nitrogen oxide emissions from stationary sources. (Page B-123)

Section 7 of the main report provides a summary of the sampling and analytical methods used to evaluate test items and air samples. The locations of the sampling points are shown in Figure 7-1 of the main report. A summary of the analytical parameters associated with each point is presented in Table 7-1 of the main report.

EPA METHOD 1 SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

METHOD! —SAMPLE AND VELOCITY TRAVELERS FOR STATIONARY SOURCES

1. Principle and Applicability

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equations. A traverse point is then located within each of these equal areas.

within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclotic or swirling (see Section 2.4). (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 30.071 m² (113 in.) cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream, from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases itsvolving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. Procedure

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible fia ne. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D) shall be calculated from the following equation, to determine the upstream and downstream distances:

where Lelength and Wewidth.

An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This precedure determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met. the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (3) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).

When the eight and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen

1

measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct d'ameters. Then, ditermine from Figure 1-1 the minimum number of traverse points that corresponds: 1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater viue, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

TABLE 1-1 CROSS-SECTION LAYOUT FOR :3ECTANGULAR STACKS

humber of Ventree bonts	Metry ig-	*
		31
2		44
•		40
0		50
5		5=
·		6-
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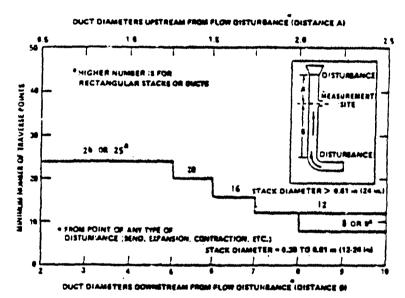


Figure 1-1. Minimum number of traverse points for particulate traverses.

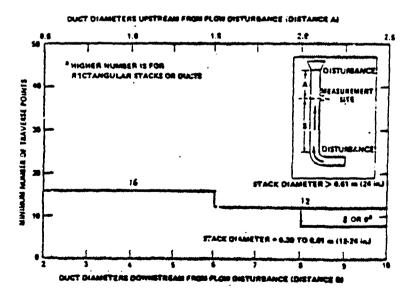


Figure 1-2. Minimum number of traverse points for valocity (nonserticulars) traverse

EPA STATIONARY SOURCE SAMPLING METHODS

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- 2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Trave 1-1.
- 2.3 Cress-sectional Layout and Location of Traverse Points.
- 2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Pigure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the ber.i. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator.

In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to cr less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3..1. Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points is located in Section 2.3.1 (all within 2.5 cm (1.00 in.) of the stack wails, relocate them away from the stack wails to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzie inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

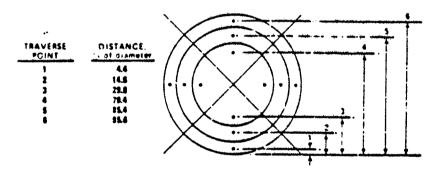


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	Number of traverse porter on a demosp											
reverse gent further en a drynaser 	2	4	•	•	10	12	14	18	18	20	22	24
	14 6 85.4	4.7 25.0 75.0 83.3	4.4 14.6 29.6 70.4 85.4 .5.6	2.2 10.5 19.4 32.3 67.7 00.8 80.5 96.8	2.9 8.2 14.6 22.6 24.2 55.8 77.4 65.4 91.8 97.4	2.1 8.7 11.8 17.7 25.0 35.0 64.4 75.0 82.3 86.2 97.8	1.8 5.7 9.8 14.6 20.1 20.6 63.4 73.1 79.8 66.4 90.1	1.8 4.9 8.5 12.5 16.8 22.0 20.3 37.5 62.5 71.7 76.8 83.1	1.8 4.4 7.5 10.9 14.6 18.8 22.8 28.6 36.2 61.8 70.4 76.4	1.3 3.9 6.7 9.7 12.9 16.5 20.4 25.0 30.6 61.2 86.4	1.1 3.5 6.0 8.7 11.6 14.6 18.0 21.8 26.2 31.5 30.3 607	19 17 16 17 27 27 27 27 27 27
							M2	87.5 91.5 96.1 96.4	81.2 86.4 88.1 92.5 95.6 96.6	75.0 79.6 83.6 87.1 90.3 83.2 84.1	06.5 73.8 76.2 62.9 66.4 66.4 61.3	80 87 77 77 80 81 M
						-				= ;	94.0 94.5 96.9	KERE

2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

If the testar degree to use more than the minimum number of traverse points. expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both less of the matrix; the final matrix need not be balanced. For example if a 4x3 minimum number of points; matrix were expanded to 36 points, the final matrix could be 9x4 or 12x1, and would not necessarily have to be 6x6. After countructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental Areas as traverse points, and locate a traverse point at the centroid of each equal area.

The situation of trave .e points being too close to the stack walls it not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cycionic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tungential inlets or other duct configurations which tend to induce swirling in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

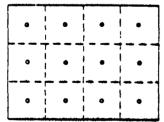


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type 3 pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "9" reference." Note the differential pressure (ap) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an accentable flow condition exists at that point, if the pitot reading is not zero at reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (a) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of an assign a values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of . is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity tra-

The alternative procedure describes in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above. The limit of acceptability for the average value of a would remain 25°.

2.5 Alternative Measurement Site Selection Procedure. This atternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than 4 duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage endwall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points: the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation.

Note.—Both the pitch and yew argies are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yew angle is the angle of the gas flow component in the plane PERPENDIGULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.

2.5.1 Apparatus.

2.5.1.1 Directional Probs. Any directional probs, such as United Sensor Type DA Three-Dimensional Directional Probs, sepable of measuring both the pitch and yaw angles of gas flows is acceptable. (Note: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign as identification number to the directional

probe, and permanently mark or engrave the number on the body of the probe. The pressure holes of directional probes are susceptible to plugging with used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "back-outging" with pressured air is required.

25.1.2 Differential Pressure Gauges, Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnehelic gauges) that meet the specifications described in Method 2, § 2.2.

Note.—If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, § 2.2.

2.3.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow § 2.3 and Table 1–1 or 1–2 for the location and leyout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this r terminative procedure, use the same traverse point number and locations for sampling and velocity measurements.

2.5.3 Measurament Procedure.
2.5.3.1 Prepare the directions obe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure Juctuations. It is recommended, but not required, that a pretest lack check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H-O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 13 seconds.

2.5.3.2 Level and zero the manometers.

Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.

2.5.3.2 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yew angle pressure gauge. Determine and record the yew angle. Record the pressure gauge readings for the pitch angla, and retermine the pitch angle from the calibration curve. Repeat this procedure for such traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point.

A post-test check as described in \$ _5.3.3 is required. If the criteria for a leak-free system are not met, repeir the equipment, and repeat the flow angle measurements.

2.5.4 Calculate the resultant angle at each fraverse point, the average resultant angle, and the etandard deviation using the following equations. Complete the calculations retaining at least one extra significant figure beyond that of the acquired data, R. and the values after the final calculations.

2.3.4.1 Calculate the resultant angle at each traverse point

R = arc cosine ((cosine YJ(cosine PJ))

Where:

R - Resultant angle at traverse point i. degree.

Y, = Yaw angle at traverse point i. degree. Pi = Pitch angis at traverse point i, degree.

2.5.4.2 Calculate the average resultant for the measurements:

where'

R - Average resultant angle, degree.

n - Total number of traverse points. 2.5.4.3 Calculate the standard deviations:

$$S_d = \sqrt{\frac{\frac{n}{\Sigma} (R_1 - \overline{R})^2}{\frac{i+1}{(n-1)}}}$$
 Eq. 1-4

S. = Standard deviation, degree.

2.5.5 The measurement location is acceptable if $\hat{R} < 20^{\circ}$ and $S_{e} < 10^{\circ}$.

2.5.6 Calibration. Use a flow system as described in Sections 4.1-2.1 and 4.1-2.2 of Method 2. In addition, the flow system shall have the capacity to generate two testsection velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3470 ft/minl.

25.61 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurements should be made at the same point in the test section, preferably at the

centroid of the test-section. 25.6.2 To ensure that the gas flow is parallel to the central axis of the test section. follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be 22° of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.

25.8.3 Pitch Angle Calibration. Perform a calibration traverse according to the manufacturer's recommended protocol in 5" increments for angles from -60° to +60° at one velocity in each of the two ranges

specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitr ble measurement factor as recommended by the manufactureri versus the pitch angle. Draw a smooth line through the Jata points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2" for angles between 0" and 40" and within 3" for angles between 40" and 60".

2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional proba to allow the determination of the yew position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the eccuracy of measurements of the yaw angle, only the zero or null position need be calilbrated as follows. Place the directional probe in the test section, end rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yew angle indicator on the three-demensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yew angle measurements could be read in order to account for variations in the pitot markings used to indicate gitot head DONLIORS.

3. Bibliography

- 1. Determining Dust Concentration in a Gas Stream, ASME, Performance Test Code No. 27. New York, 1957.
- 2. Devorkin, Howard, et al. Air Pollution Source Testing Manual. Air Poliution Con-trol District. Los Angeles, CA. November 1963
- 3. Methods for Determination of Velocity. Volume. Dust and Mist Content of Gases. Western Precipitation Division of Joy Manufacturing Co. Los Angeles, CA. Bulletin WP-50. 1968.
- 4. Standard Method for Sampling Stacks for Particulate Matter. In: 1971 Book of ASTM Standards. Part 23. ASTM Designation D-2928-71. Philadelphia, Pa. 1971.
- 5. Hanson, H. A., et al. Particulate Sampling Strategies for Large Power Plants Including Nonuniform Plow. USEPA, ORD, ESRL, Research Triangle Park, H.C. EPA-600/2-76-170, June 1976.
- 6. Entropy Environmentalists. Inc. Determination of the Optimum Number of Sampling Points: An Analysis of Method 1 Critetia. Environmental Protection Agency, Research Triangle Park, N.C. EPA Contract No. 68-01-3172, Task 7
- 7. Hanson, H.A., R.J. Davini, J.E. Morgan, and A.A. Iversen, Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow, U.S. Environmental Pro-tection Agency, Research Triangle Park, N.C. Publication No. EPA-609/2-76-170.
- June 1976, 363 p.
 8. Brooks, E.F., and R.L. Williams, Plow and Gas Sampling Manual. U.S. Environ-mental Protection Agency, Research Triangle Park. N.C. Publication No. EPA-400/2-76-203. July 1976. 93 p.
- 9. Entropy Environmentalists, Inc. Traverse Point Study, EPA Contract No. 68-02-3172. June 1977. 19 p.

10. Brown, J. and K. Yu. Test Report: Particulate Sampling Strategy in Circular Ducts. Emusion Measurement Branch. Emission Standards and Engineering Divi-U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711, July 31, 1980, 12 p.
11. Hawksley, P.G.W., S. Badziech, and J.H. Blackett, Measurement of Solids in

Flue Gares, Leatherhead, England, The Brilish Coal Utilization Research Associa-

tion, 1961, p. 129-133. 12. Knapp, K.T. The Number of Sampling Points Needed for Representative Source Sampling. In: Proceedings of the Fourth National Conference on Energy and the Environment, Theodore, L., et al. (ed.). Dayton,

13. Smith, W.S. and D.j. Grove. A Proposed Extension of EPA Method 1 Criteria. Pollution Engineering," XV(8):36-37. August 1981.

14. Gerhart, P.M. and M.J. Dorsey. Investigation of Field Test Procedures for Large Fens. University of Akron. Akron. Ohio. (EPRI Contract CS-1851). Final Report (RP-1649-5) December 1900.

15. Smith, W.S. and D.J. Grove. A New Look at Isokinatic Sampling-Theory and Applications. "Source Evaluation Society Newsletter." VIII(3):19-24. August 1963.

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EPA METHOD 2

DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

METHOD 2-DITERMINATION OF STACK GAS VILOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. Principle and Applicability

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow

This procedure is not applicable at measurement sites which fall to meet the criteria of Method 1. Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. Whell unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate strichlometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. Apparatus

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g. stainless steel). It is recommended that the external tubing diameter (dimension D. Figure 2-2b) be between 0.48 and 0.95 centimeters (% and % inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P. and P. Figure 2-2b): it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permusible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. an identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

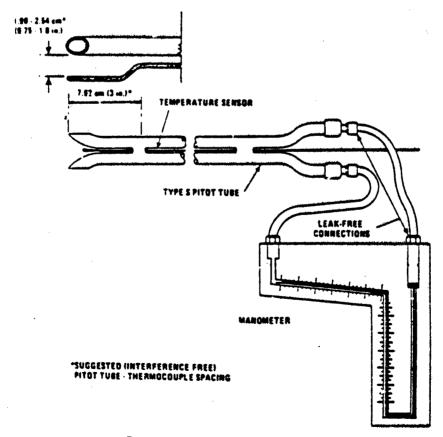
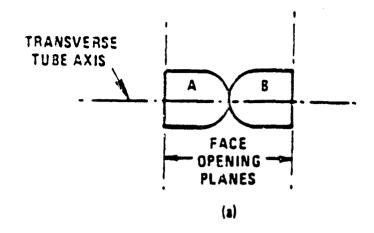


Figure 2-1. Type 5 pitot tube manometer assembly.

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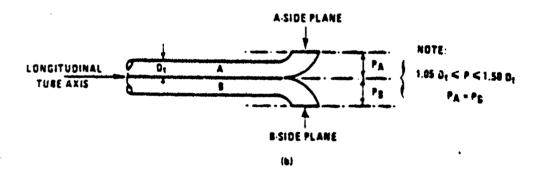




Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis: (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerines coincident, when viewed from both sides. Baseline operficient values of 0.84 may be assigned to pitot tubes constructed this way.

(c)

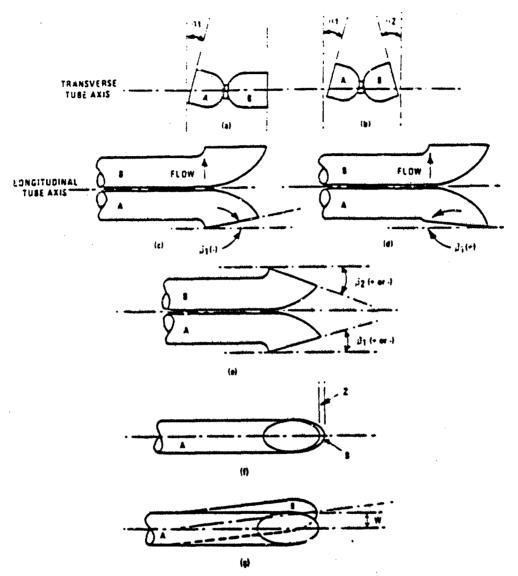


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S prior tubes. These will not affect the baseline value of Cp(s) so long as α1 and α2 10°, β1 and β2 5°, z 0.32 cm (1/8 in.) and w 0.08 cm (1/32 in.) (citation 11 in Section 6).

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Ap) reading at

the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same (± 5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be

taken, as above, for the last two back purges at which suitably high up readings are obtained

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in (water column) inclined-vertical manometer, naving 0.01-in. H.O divisions on the 0-to 1-in inclined scale, and 0.1-in. H.O divisions on the 1- to 10-in vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of ap values as low as 1.3 mm (0.05 in.) Li.O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic aver age of all as readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) R.O; (2) for traverses of 12 or more points. more than 10 percent of the individual ap readings are below 1.3 mm (0.05 in.) H,O; (3) for traverses of fewer than 17 points, more than one Ap reading is below 1.3 mm (0.78 ln.) H.O. Chatton 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas veloci-U

(3) above, the following calculation may be performed to determine the necessity of the amore sensitive differential pressure gauge:

$$T = \frac{\sum_{i=1}^{N} \sqrt{\Delta p_i + K}}{\sum_{i=1}^{N} \sqrt{\Delta p_i}}$$

where:

an - Individual velocity head reading at a traverse point, min Had (in, Had).

... Total number of traverse points.

X= 3.13 mm (I₂O) when metric units are used and 0.005 in H₂O) when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

No. of If differential pressure gauges other than inclined manometers are used (e.g., magnehetic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare ap readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of ap values in the stack. If, at each point, the values of an extend by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured ap values and final results shall be used subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled buib thermometer, bimetallic thermometer, mercury in glass thermometer, or other gauge, capable of measuring temperature to within 1.3 percent of the minimum sheelute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal: the gauge shall be in an interference-free acrangement with respect to the pitet tube face openings (see Figure 2-1 and also Pigure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than I percent in the average velocity measurement is introduced. the temperature gauge need not be attached to the pitot tube; this Liternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A plesometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, anaroud er other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be reduced and an adjustment (or elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vica-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination: other methods may be used subject to approval of the Administrator.

2.7 Calibration Pilot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitnt tube is used as a reference. The standard pitot tube mail, preferably, have a known coefficient. chained either (1) directly from the Nationil Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01.

2.7.1 Hemispherical (shown in Figure 2-

4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube. following the 90 degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piesometer ring configuration.

2.7.5 Ninety degree bend, with curved or

mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the singipalicity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H₂O (0.008 in. H₂O). For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm H₂O (0.005 in H₂O) for a values between 1.3 and 25 mm H₂O (0.05 and 1.0 in. H₂O), and to the nearest 1.3 mm H₂O (0.05 in. H₂O). A special, more sensitive gauge will be required to read 29 values below 1.3 mm H₂O (0.05 in. H₂O) (see Citation 18 in Section 6).

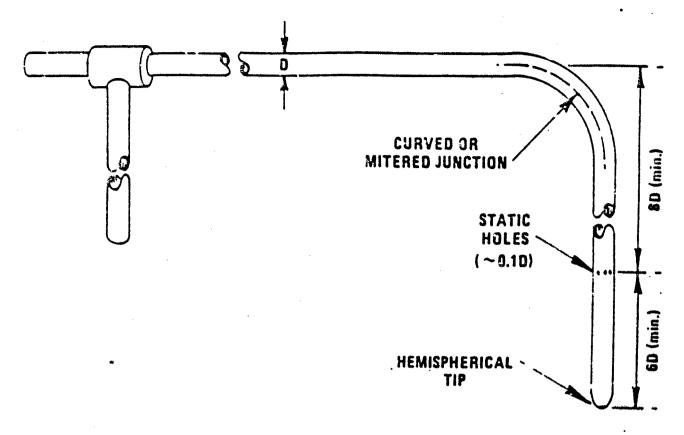


Figure 2-4. Standard pitot tube design specifications.

3. Procedure

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the transmeter and pitot tube may be used to dampen ap fluctuations. It is recommended, but not required. that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H₂O velocity pressure register; on the manometer. then close off the impact opening. The pressure shall remain stable for at least 15 seconds: (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H.O. Other leakthe Administrator may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may

drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-3).

3.3 Measure the velocity head and tembecause the venomity need and tem-perature at the traverse points specified by Method 1. Ensure that the proper differen-tial pressure gauge is being used for the range of Ap values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Ap and temperature readings at each traverse point. Conduct a post-test leak-cheek (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pres

PLANT	
DATE RUN NO	
STACK DIAMETER OR DIMENSIONS, m(in.)	
BAROMETRIC PRESSURE, mm Hg (in. Hg)	
CROSS SECTIONAL AREA, m2(ft2)	
OPERATORS	
PITOT TUBE I.O. NO.	
AVG. COEFFICIENT, Ca -	
LAST DATE CALIBRATED	AA

Traverse	Vol. Hd., Δa mm (m.) Hg6	Stack To	meerstwee	Pg mm Hg (sn.Hg)		
Pt. No.		14" aC (ak)	Tt. *K (*R)		√ 4.0	
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Figure 2-5. Velocity traverse data.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO₀, O₀, CO, and N₀, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from

Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blue-prints.

4. Calibration

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

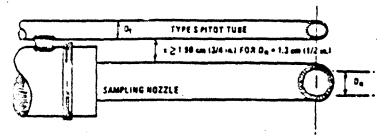
ment specifications.

After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D. Figure 2-2bt and (b) the base-to-opening plane distances (dimensions P. and P., Figure 2-2bt. If D is between 0.48 and 0.98 cm (%) and % in.) and

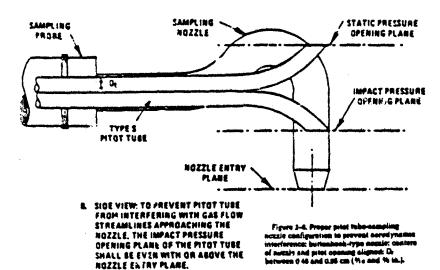
If P. and P. are equal and between 1.0. 1.50 D., there are two possible option the pitot tube may be calibrated account to the precedure outlined in Sections through 4.1.5 below, or (2) a baseline (i est tube) coefficient value of 0.84 may isgued to the pitot tube. Note, however if the pitot tube is part of an assembly bration may still be required, despite kindge of the baseline coefficient value Section 4.1.1).

Section 4.1.1).

If A_i , A_i , and A_i are outside the spellmits, the pitet tube must be calibrat outlined in 4.1.2 through 4.1.5 below.



A. BOTTOM VIEW: SHOWING MINIMINIM PITOT NOZZLE SEPARATION.



4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitch tube is not always used: in many instances, the pitot tube is used in combination with other source-samgling components (thermocouple, sampling probe, notzie) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwire known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative piacement of the components in the assembly is such that serodynamic interference effects are eliminated. Figures 2-4 through 2-4 illustrate interference-tree component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (% and % in.). Type S pitot tube assemblies that fall to meet any or all of the specifications of Pigures 2-6 through 2-6 shall be calibrated excording to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (Ditot-nozzie, pitot-thermocouple, pitotprobe sheath) shall be measured and record-

Norm Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nomie (see Figure 2-4b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube snall be permanently marked A, and the other. B. Calibration shall be done in a flow system having the following essential design features:

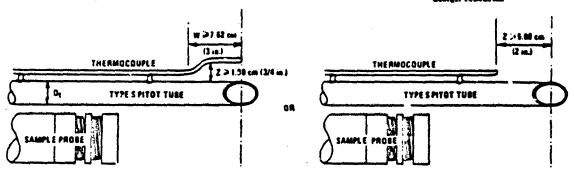


Figure 2-7. Proper thermocouple placement to prevent interference; D_2 between 0.48 and 0.95 cm (3/10 and 3/8 in.).

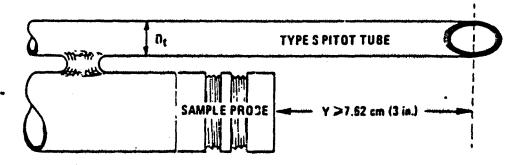


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; Dt between 0.48 and 0.95 cm (3/16 and 3/8 in.).

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4.1.2.1 The flowing gas stream must be confined to a duct of definit - mas-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectanguiar cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.22 The cross-sectional area of the calibration duct must be " natant over a dis-tance of 10 or more state diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters

$$D = \frac{2LW}{(L+W)}$$

Equation 2-1

where: D. - àquivalent diameter L=Length W- Width

To ensure the presence of stable, fully developed flow patterns at the calibration site. or "test section," the site must be located at least sight diameters downstream and two diameters upstream from the nearest disturbances

NOTE The eight- and two-diameter criteris are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test rite is stable and demonstrably

parallel to the duct axis.
4.1.2.3 The flow system shall have the especity to generate a test-section velocity around 913 m/min (3,000 [t/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at \$15 m/min (3,000 ft/min) will generally be valid to within ±3 percent for the measurement of velocities above 305 m/min (1.000 ft/min) and to within ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1.525 m/ min (600 to 5,000 (t/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type 8 pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain cali-bration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines: repair or replace if neces

CALIBRATED BY: . "A" SIDE CALIBRATION 2000 1061 cm HZO or HyO DEVIATION RUN NO. (in. H20) (in. H20) $C_{p(s)}$ Cp(s) Cp(A) 1 2 3 C. ISIBE AI

_ DATE.

PITOT TUSE IDENTIFICATION NUMBER:

	8 211			
RUN NG.	△##d cm H20 (in. H20)	∆#(d cm H2Q (in, H2Q)	C _{p(1)}	OEVIATION C _{p(t)} · C _p (B)
1				
2				
1				
		C _p (SIBE 8)		

$$\frac{1}{2} \left| c_{p}(a - \tilde{c}_{p}(a + 0 + 0)) \right|$$
AVERAGE DEVIATION - u (A O.S. 8) -
$$\frac{1}{3}$$
MUST SE < 8.91

C, ISIDE A) - C, ISIDE BI --- MUST BE < 8.00

Figure 2-9. Pitot tube calibration data.

4.1.3.2 Level and zero the managemeter. Turn on the fan and allow the flow to stablline. Seal the Type S entry port.

4.1.3.3 Emsure that the manometer is level and seroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular car should be taken in aligning the tube to avoid yaw and petch angles. Make sure that the entry port surrounding the tube is properly sealed

4.1.3.4 Rend A., and record its value in a data table similar to the one shows in Pigure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type 5 pitot tube to the manometer. Open the Type S entry Lort. Check the manometer level and zero. Insert and align the Type S pitot tube se that its A side impact opening is at the same

is as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is orly sealed

1

4.1.3.6 Read ap, and enter its value in the sia table. Remove the Type S pitot tube seen the dust and disconnect it from the

4117 Heyest steps 4.1.3.3 4.1.3.6 above until three pairs of ap readings se been obtained.

41.3.8 Repeat steps 41.18 Repeat steps 4.1.33 through 41.3.7 above for the B side of the Type S at tube

4.1.2.9 Perform calculations, as described in Section 4.1.4 below.

41.4 Calculations

41.4.1 For each of the six bairs of as realings (La., three from side A and three from side B) obtained in Section 4.1.3 above. calculate the value of the Type S pitot tube

Lauation 2-2

vhere:

Command Type S pitut tube coefficient: Use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

\(\frac{1}{2}p_{ma} = \text{Velocity head measured by the standard pitot tube, cm H₂O (in, H₂O)

Ap. = Velocity head measured by the Type S pitot tube, cm H_iO (in H_iO)

4.1.4.2 Calculate \overline{C}_{p} (side A), the mean A-side coefficient, and \overline{C}_{p} (side B), the mean B-side coefficient: calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of \vec{C}_{po} , from \vec{C}_p (side A), and the deviation of each B-side value of \vec{C}_{pol} from \vec{C}_p (side B). Use the following equation:

Deviation $= C_{per} - \overline{C}_p(A \text{ or } B)$

Equation 2-3

4.1.4.4 Calculate σ , the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$= (\text{side A or B}) = \frac{\sum_{i=1}^{3} |C_{\#i} - \widehat{C}_{p}(A \text{ or } B)|}{3}$$

Enuation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between C_{σ} (A) and C_{σ} (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

4.1.3.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., G, (side A) and G, (side B), will be valid, so long as either (1) the isolated pitot tube is used or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6, and 2-6).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches

off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzie interference is a fac r (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of Com depends upon the amount of freespace between the tube and nozzle, and therefore is a function of nozzie size. In these instances, separate calibrations shall be performed with each of the commonly used nozzie sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or % in.) are not ordinarily used for isokinetic sampling at velocities around 215 m/min (3,000 ft/ min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (#) value of 0.01 or less (see Section 4.1.4.4).

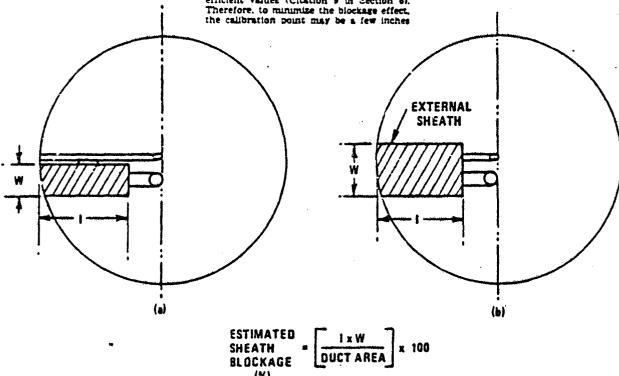


Figure 2-10. Projected area models for typical pitot tube assemblies.

Tgure 2-10. Projected-area models for typial pitot tube assemblies.

4.1.6 Pield Use and Recalibration.

4.1.5.1 Fleid Use. 4.1.5.1.1 When a Type S pitot tube (isosted tube or assembly) is used in the fleid. he appropriate coefficient value (whether ssigned or obtained by calibration) shall be sed to perform velocity calculations. For alibrated Type S pitot tubes, the A side coifficient shall be used when the A side of he tube faces the flow, and the B side coeficient shall be used when the B side faces he flow: alternatively, the anthmetic averge of the A and B side coefficient values tay be used, irrespective of which side faces

4.1.6.1.2 When a probe assembly is used a sample a small duct (12 to 36 in. in diameer), the probe sheath sometimes blocks a smillcant part of the duct cross-section. susing a reduction in the effective value of Consult Citation 9 in Section 6 for deuls. Conventional pitot-sampling probe asemblies are not recommended for use in ucts having inside diameters smaller than 2 inches (Citation 16 in Section 6).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each eid use, the pitot tube shall be carefully rexamined in top, side, and end views. If he pitot face openings are still sligned ithin the specifications illustrated igure 2-2 or 2-3, it can be assumed that the assime coefficient of the pitot tube has not hanged. If, however, the tube has been amanged to the extent that it no longer iests the specifications of Figure 2-2 or 2the damage shall either be repaired to reore proper alignment of the face openings r the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After sch field use, check the face opening alignient of the pitot tube, as in Section 1.5.2.1; also, remeasure the intercomponat spacings of the assembly. If the interimponent spacings have not changed and te face opening alignment is acceptable. It un be assumed that the coefficient of the ssembly has not changed. If the face openig alignment is no longer within the specications of Figures 2-2 or 2-3, either repair te damage or replace the pitot tube (cali-rating the new assembly, if necessary). If te intercomponent spacings have changed. istore the original spacings or recalibrate te sesembly.

4.2 Standard pitot tube (if applicable). If standard pitot tube is used for the velocity averse, the tube shall be constructed ac-ording to the criteria of Section 2.7 and tall be assigned a baseline coefficient value 10.99. If the standard pitot tube is used as art of an assembly, the tube shall be in an iterference-free arrangement (subject to te approval of the Administrator).

4.3 Temperature Gauges. After each eid use, calibrate dial thermometers, quid-filled buib thermometers, thermocoue-potentiometer systems. and luges at a temperature within 10 percent I the average absolute stack temperature, or temperatures up to 405° C (761° P), use n ASTM mercury-in-glass reference therometer, or equivalent, as a reference; almatively, either a reference thermocouple ad potentiometer (calibrated by NBS) or termometric fixed points, e.g., ice bath and piling water (corrected for barometric presire) may be used. For temperatures above C (761° P), use an NBS-calibrated referice thermocouple-potentiometer system of a sitemate reference, subject to the ap-roval of the Administrator.

If, during calibration, the absolute teraperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission is t shall either be considered invalid or adjustments (if appropriate) of the test results /nail be made, subject to the approval of the Admin-

4.4 Barometer, Calibrate the barometer used against a mercury barometer.

5. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenciature.

Am Cross-sectional area of stack, ma (ft ?). B. .. Water vapor in the gas stream (from Method 5 or Reference Method 4), preportion by volume.

C. . Pitot tube coefficient, dimensioniess. K .- Pitot :ube constant.

for the metric system and

for the English system.

AL - Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).

M.-Molecular weight of stack gas, wet basis, ¢/¢-mole (Ib/Ib-mole).

-M. (1 - 8-) + 18.0 8-

Equation 2-5

P ... Barometric pressure at measurement site, mm Hg (in. Hg).

P, -Stack static pressure, mm Hg (in. Hg).

P. - Absolute stack gre pressure, man Hg (in. Hg). -2-+2,

Eau stion 2-4

P. Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q. Dry volumetric stack gas flow rate corrected to standard conditions, decm/hr (duct/hr).

4=Stack temperature, 'C ('P). T,=Absolute stack temperature. 'K. ('R). = 273+4 for metric

Equation 2-7

-460+L for English

Equation 2-8 7_m -Standard absolute temperature, 293 °E (528° R)

a. Average stack ras velocity, m/sec (ft/ seci.

4. - Velocity head of stack gas, mm E.O (in. H.O). 3.500 - Conversion factor, sec/hr.

18.0 - Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average stack gas velocity.

$$\bullet_* = K_*C_*(\sqrt{\Delta p})_{\bullet,\bullet} = \sqrt{\frac{T_{\text{name}}}{P_*M_*}}$$

Equation 2-9

5.3 Average stack gas dry volumetric flow

$$Q_{\rm m} = 1,500(1 - B_{\rm mi}) v_{\rm mid} \qquad \left(\frac{T_{\rm res}}{T_{\rm reserv}}\right) = \left(\frac{P_{\rm r}}{P_{\rm mid}}\right)$$

Equation 2-10

To convert Q_ In decm/hr (decf/hr) to decm/min (decf/ mist divide Q by 60."

4. Bibliography

1. Mark, L. S. Mechanical Engineers' Handbook, New York, McGraw-Hill Book Co., Inc. 1951.

2. Perry, J. H. Chemical Engineers' Handbook. New York. McGraw-HILL Book Co.

Inc. 1988.

J. Shigehara, R. T., W. F. Todd, and W. S. Smith. Significance of Errors in Stack Sam-pling Measurements. U.S. Environmental Protection Agency, Research Triangle Park. N.C. (Presented at the Annual Meeting of the Air Pollution Control Association, St. Louis. Me., June 14-19, 1970.)

4. Standard Method for Sampling Stacks for Particulate Matter. In: 1971 Book of ASTM Standards, Part 23. Philadelphia, Pa. 1971. ASTM Designation D-2928-71.

5. Vennard, J. K. Elementary Fluid Mechange New York, John Wiley and Sons. Inc. 1947.

6. Fluid Meters-Their Theory and Application, American Society of Mechanical Engameers, New York, N.Y. 1959.

1. ASHRAE Handbook of Fundamentals. 1972 p. 204.

S. Annual Book of ASTM Standards, Part 28. 1974. p. 648.

9. Vollaro, R. P. Guidelines for Type 3 Pitot Tube Calibration. U.S. Environmental Protection Agency, Research Triangle Park. N.C. (Presented at 1st Annual Meeting, Source Evaluation Society, Dayton, Ohio, September 18, 1975.)

10. Vollare, R. P. A Type S Pitot Tube Calibration Study. U.S. Environmental Pro-tection Agency. Emission Measurement Branch, Research Triangle Park, N.C. July 1974

11. Vollare, R. F. The Effects of Impact Opening Misalignment on the Value of the Type S Pitot Tuos Coefficient. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, N.C. October 1976.

12. Vollars, R. P. Extablishment of a Bas-line Coefficient Value for Properly Con-structed Type S Pitot Tubes. U.S. Environmental Protection Agency. Emission Messurement Branch, Research Triangle Park N.C. Movember 1976.

13. Vellaro, R. P. An Evaluation of Single-Velocity Calibration Technique as a Means of Determining Type S Pitot Tubes Coefficient. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park N.C. August 1975.

14. Vollara, R. P. The Use of Type S Pitot Tubes for the Measurement of Low Velocities, U.S. Environmental Protection Agency. Emission Measurement Branch, Research Triangle Park N.C. November 1976.

- 15. Smith, Marvin L. Velocity Calibration of EPA Type Source Sampling Probe. United Technologies Corporation, Fratt and Whitney Aircraft Division, East Hartford, Conn. 1975.
- 16. Vollaro, R. F. Recommended Procedure for Sample Traverses in Ducts Smaller than 12 Inches in Diameter. U.S. Environmental Protection Agency. Emission Measurement Branch. Research Triangle Park N.C. November 1976.
- 17. Ower. E. and R. C. Pankhurst. The Measurement of Air Flow, 4th Ed., London, Pergamon Press, 1966.
- 18. Voilaro, R. F. A Survey of Commercially Available Instrumentation for the Measurement of Low-Range Gas Velocities. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, N.C. November, 1976, (Unpublished
- Park N.C. November 1976. (Unpublished Paper)
- Paper)

 19. Gnyp. A. W., C. C. St. Pierre, D. S. Smith, D. Moczon, and J. Steiner, An Experimental Investigation of the Effect of Pitot Tube-Sampling Probe Configurations on the Magnitude of the S Type Pitot Tube Coefficient for Commercially Available Source Sampling Probes, Prepared by the University of Windsor for the Ministry of the Environment, Toronto, Canada, February 1975.

EPA METHOD 25A

DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION USING A FLAME IUNIZATION AVALYZER

METHOD 25A-DETERMINATION OF TOTAL GAS-EOUS ORGANIC CONCENTRATION USING A FLAME IONIZATION ANALYZES.

1. Applicability and Principle

Applicability. This method applies to the measurement of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

1.2 Principle. A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

2. Definitions.

2.1 Measurement System The equipment required for the determination of the gas concentration. The system con-

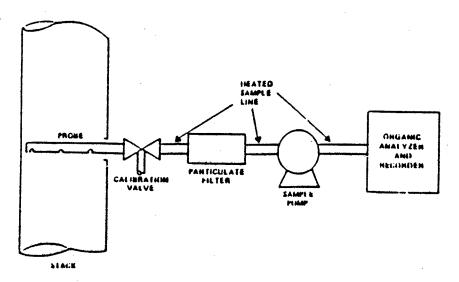
sists of the following major subsystems:
2.1.1 Sample Interface. That portion of the system that is used for one or more of the following: sample acquisition, sample transportation, sample conditioning, or protection of the analyzer from the effects of the stack effluent.

2.1.2 Organic Analyzer. That portion of the system that senses organic concentration and generates an output proportional

to the gas concentration.

- 2.2 Span Value. The upper limit of a ras concentration measurement range that is specified for affected source categories in the applicable part of the regulations. The span value is established in the applicable regulation and is usually 1.5 to 2.5 times the applicable emission limit. If no span value is provided, use a span value equivalent to 1.5 to 2.5 times the expected concentration. For convenience, the span value should correspond to 100 percent of the recorder scale.
- 2.3 Calibration Gas. A known concentra-
- tion of a gas in an appropriate diluent gas.

 2.4 Zero DrvL The difference in the
 measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.
- 2.5 Calibration Drift. The difference in the measurement system response to a midlevel calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair or adjustment took piece.
- 2.6 Response Time. The time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.
- 2.7 Calibration Error. The difference b tween the gas concentration indicated by the measurement system and the known concentration of the calibration gas.
 - L Apparatus
- A schematic of an acceptable measurement system is shown in Figure 25A-1. The essential components of the measurement system are described below:



France 25A L. Chyante Consumtration Magazinamini System.

3.1 Organic Concentration Analyzer. A flame ionization analyzer (FIA) capable of meeting or exceeding the specifications in this method.

12 Sample Probe Stainless steel equivalent, three-hole rake type. Sample holes shall be 4 mm in diameter or smaller and located at 16.7, 50, and 83.3 percent of the equivalent stack diameter. Alternatively, a single opening probe may be used so s a gas sample is collected from the centrally located 10 percent area of the stack cross-section.

1.1 Sumple Line Stainless steel Teflone tubing to transport the sample gas to the analyzers. The sample line should be heated, if beceasery, to prevent condensa-tion in the line.

14 Calibration Valve Assembly. A threeway valve assembly to direct the zero and calibration gases to the analyzers is recommended. Other methods, such as quick-connect lines, to route calibration gas to the analyzers are applicable.

3.5 Particulate Filler. An in-stack or an out-of-stack glass fiber filter is recommended if exhaust gas particulate loading is xignificant. An out-of-stack filter should be hested to prevent any condensation.

Le Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording requirement is one measurement value per minute. Note: This method is often applied in highly explosive areas. Caution and care should be exercised in choice of equipment and installation.

4. Calibration and Other Gases.

Gases used for calibrations, fuel, and combustion air (if required) are contained in compressed gas cylinders. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in Reference 9.2. Additionally, the manufacturer of the cylinder should provide a rec-

ommended shelf life for each calibration cas cylinder over which the concentration do not change more than #2 percent from the certified value. For calibration gas values not generally available (i.e., organics between 1 and 10 percent by volume), alternative methods for preparing calibration ras mixtures, such as dilution systems, may be used with prior approval of the Administra-

Calibration gases usually consist of pro-pane in air or nitrogen and are determined in terms of the span value. Organic compounds other than propane can be used foilowing the above guidelines and making the appropriate corrections for response factor.

4.1 Fuel A 40 percent H₁/60 percent He

or 40 percent H. 60 percent N.gas mixture is recommended to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.

4.2 Zero Gas. High purity air with less than 0.1 parts per million by volume (ppmy) of organic material (propage or carbon equivalent) or less than 0.1 percent of the span value, whichever is greater.

I.J Low-level Calibration Gas. An organ-calibration gas with a concentration 4.3 equivalent to 25 to 35 percent of the appli-

cable span value.

4.4 Mid-level Calibration Gas. An organic calibration gas with a concentration equivalent to 45 to 5 percent of the applicable span value.

4.5 High-level Calibration Gas. An organic calibration gas with a concentration equivalent to 80 to 90 percent of the appli-

cable span value.

5. Measurement System Performance Speciffer itions.

il Zero Drift Less than 23 percent of the span value.
5.2 Calibration Drift Less than =3 per-

cent of span value.

5.3 Calibration Error. Less than =5 percent of the calibration gas value.

6. Pretest Preparations.

6.1 Selection of Sampling Site. The location of the sampling site is generall; specified by the arplicable regulation or purpose of the test; i.e., exhaust stack, inlet line, etc. The sample port shall be located at least 1.3 meters or 2 equivalent diameters (whichever is less) upstream of the gas discharge to the atmosphere.

6.2 Location of Sample Probe. Install the sample probe so that the probe is centrally located in the staci., pipe, or duct and is sealed tightly at the stack port connection.

6.3 Measurement System Preparation. Prior to the emission test, assemble the measurement system following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. Make the system operable.

FIA equipment can be calibrated for almost any range of total organics concentrations. For high concentrations of organics (>1.0 percent by volume as propane) modifications to most commonly available analyzers are necessary. One accepted method of equipment modification is to decrease the size of the sample to the analyzer through the use of a smaller diameter sample capillary. Direct and continuous measurement of organic concentration is a necessary consideration when determining

any modification design.

6.4 Calibration Error Test Immediately prior to the test series, (within 2 hours of the start of the test) introduce zero gas and high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary, Calculate the predicted response for the lowlevel and mid-level gases based on a linear response line between the zero and highlevel responses. Then introduce low-level and mid-level calibration gases successively to the measurement system. Record the analyzer responses for low-level and mid-level culbration gases and determine the differences between the measurement system responses and the predicted responses. These differences must be less than 5 percent of the respective calibration gas value. If not, the measurement system is not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift check (Section 7.3). If adjustments are necessary before the completion of the test series, perform the drift checks prior to the required adjustments and repeat the calibration following the adjustments. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration yas to verify the multiplication factor.

6.5 Response Time Test Introduce sere sas into the measurement system at the calibration valve assembly. When the system output has stabilized, switch quickly to the high-level calibration gas. Record the time from the concentration change to the measurement sy a response equivalent to 95 percent of t' step change. Repeat the test three time and average the results.

7. Emission Measurement Test

7.1 Organic Measurement Begin sampling at the start of the test period, recording time and any required process information as appropriate, in particular, note on the recording chart periods of process interruption or cyclic operation.

7.2 Druft Determination. Immediately following the completion of the test period and hourly during the test period, reintroduce the zero and mid-level calibration gases, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after both the zero and calibration drift checks are made.) Record the analyzer response. If the drift values exceed the specified limits, invalidate the test results preceding the check and repeat the test following corrections to the measurement system. Alternatively, recalibrate the test measurement system as in Section 6.4 report the results using both sats of calibration data (i.e., data determined prior to the test period and data determined following the test periodi.

8. Organic Concentration Calculations.

Determine the average organic concentration in terms of ppmy as propone or other cambration gas. The average shall be determined by the integration of the output recording over the period specified in the apniicable regulation.

If results are required in terms of pone as carbon, adjust measured consentrations using Equation 25A-1.

C,- K C....

Eq. 25A-1

Where:

C,=Organic concentration as carbon, ppmv. Com-Organic concentration as measured. DDMY.

K = Carbon equivalent correction factor,

K=2 for ethane.

K=3 for propage.

K-4 for butane.

K-Appropriate response factor for other organic calibration gases.

9. Bibliographs.

9.1 Measurement of Volatile Organic Compounds—Guideline Series. U.S. Environmental Protection Agency, Research Triangle Park, N.C. Publication No. EPA-450/ 2-78-041. June 1978. p. 46-54.

9.2 Traceability Protocel for Establishing True Concentrations of Cases Used for Calibration and Audits of Continuous Source Emission Monitors (Protocol No. 1). U.S. Environmental Protection Agency, Environ-mental Monitoring and Support Laboratory. Research Triangle Park, N.C. June 1978.

9.3 Gasoline Vapor Emission Laboratory Evaluation—Part 2. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Trangle Park, N.C. EMB Report No. 75-GAS-4, August 1978.

EPA METHOD 3

GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

METHOD 3—GAS ANALYSIS FOR CARBON DIOX-IDE, OXYGEN, EXCESS AIR, AND DRY MOLEC-ULAR WEIGHT

1. Principle and Applicability

1.1 Principle. A gas sample is extracted from a stack, by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent carbon dioxide (CO₂), percent oxygen (O₂), and, if necessary, percent carbon monoxide (CO). If a dry molecular weight determination is to be made, either an Orsat or a Fyrite! analyzer may be used for the analysis; for excess air or emission rate correction factor determination, an Orsat analyzer must be used.

1.2 Applicability. This method is applicable for determining CO₂ and C₃ concentrations, excess air, and dry molecular weight of a sample from a gas stream of a fossifuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO₂, O₃, CO, and nitrogen (n₂) are not present in concentrations sufficient

to affect the results.

Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point: (2) a method using CO, or O, and stoichiometric calculations to determine dry molecular weight and excess air; (3) assigning a value of 30.0 for dry molecular weight, in lieu of actuss measurements, for processes burning natural gras, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator, U.S. Environmental Protection Agency.

2. Apparatus

As an alternative to the sampling apparatus and systems described hercin, other sampling systems (e.g., liquid displacement) may be used provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are otherwise capable of yielding raceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. The probe should be made of stainless steel or borosilicate glass tubing and should be equipped with an in-stock or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other materials inert to O., CO., CO. and N. and resistant to temperature at sampling conditions may be used for the probe: examples of such material are aluminum, copper, quartz glass and Teffon.

2.1.2 Pump. A one-way squeeze buib, or equivalent, is used to transport the gas

sample to the analyzer.

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2.2 Integrated Sampling (Figure 3-2).
2.2.1 Probe. A probe such as that described in Section 2.1.1 is mutable.

'Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency. 2.2.2 Condenser. An air-cooled or water-cooled condenser, or other condenser that will not remove O_n CO_n CO, and N_n may be used to remove excess moisture which would interfere with the operation of the pump and flow meter.

2.2.3 Valve. A needle valve is used to adjust sample gas flow rate.

2.2.4 Pump. A leak-free, diaphragm-type pump, or equivalent, is used to transport sample gas to the flexible bag, install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 Rate Meter. The rotameter, or equivalent rate meter, used should be capable of measuring flow rate to within ±2 percent of the selected flow rate. A flow rate range of 500 to 1000 cm//min is suggested.

2.2.8 Flexible Bag. Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-costed aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consutent with the selected flow rate and time

length of the test run, may be used. A capacity in the range of 55 to 90 liters is suggested.

To leak-check the bag, connect it to a water manometer and pressurize the bag to 5 to 10 cm H₂O (2 to 4 in, H₂O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm H₂O (2 to 4 in, H₂O) and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 Pressure Gauge. A water-filled Utube manometer, or equivalent, of about 30 cm (12 in.) is used for the flexible bag leakcheck.

2.2.8 Vacuum Gauge. A mercury manometer, or equivalent, of at least 760 mm Hg (30 in, Hg) is used for the sampling train least-check.

2.3 Analysis. For Orset and Pyrite analyses maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

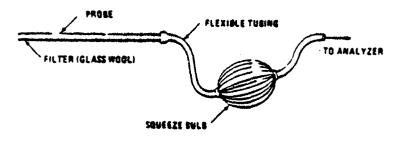


Figure 3-1. Grati sampling train

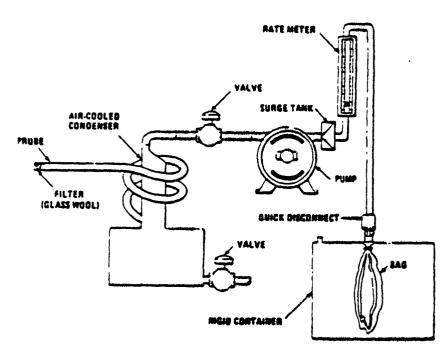


Figure 3-2, integrated gen-correling train

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2.3.1 Dry Molecular Weight Determination. An Orsat analyzer or Pyrite type combustion gas analyzer may be used.

2.3.2 Emission Rate Correction Pactor or Excess Air Determination. An Orsat analyser must be used. For low CO₂ (less than 4.0 percent) or high O₂ (greater that 15.0 percent) concentrations, the measuring burette of the Orsat must have at least 0.1 percent subdivisions.

3. Dry Molecular Weight Determination

Any of the three sampling and analytical procedures described below may be used for determining the dry molecular weight.

- 3.1 Single-Point, Grab Sampling and Analytical Procedure.
- 3.1.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. If and Orsat analyzer is used, it is recommended that the analyzer be leaked-checked by following the procedure in Section 5; however, the leak-check is optional.

3.1.3 Place the probe in the stack, with the tir of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer and immediately analyze it for percent CO, and percent O. Determine the percentage of the gas that is N, and CO by subtracting the sum of the percent CO, and percent O, from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.1.4 Repeat the sampling, analysis, and calculation procedures, until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (lb/lb-mole).

3.2 Single-Point, Integrated Sampling and Analytical Procedure.

3.2.1 The sampling point in the duct shall be located as specified in Section 3.1.1.
3.2.2 Leak-check (optional) the flexible

3.2.2 Leak-check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible hag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

3.2.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft?) of sample gas is recommended; however, smaller volumes may be collected, if desired.

3.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyse it for percent Co. and percent O. using either an Orsat analyzer or a Fyrite-type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that the Orsat leak-check described in Section 5 be performed before this determination: however, the check is outlonat.

Determine the percentage of the gas that is N, and CO by subtracting the sum of the percent CO, and percent O, from 100 percent. Calculate the dry molecular weight as indicated in Section 3.3.

3.2.5 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 s/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

3.3 Multi-Point, Integrated Sampling and Analytical Procedure.

3.3.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

3.3.2 Follow the procedures outlined in sections 3.2.2 throught 3.2.5, except for the following: traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4. Emission Rate Correction Factor or Excess Air Determination

Note: A Pyrite-type combustion gas analyzer is not acceptable for excess air or emission rate correction factor determination, unless approved by the Administrator. If both percent CO, and percent O, are measured, the analytical results of any of the three procedures given below may also be used for calculating the dry molecular weight.

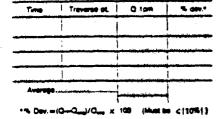
Each of the three procedures below shall be used only when specified in an applicable subpart of the standards. The use of these procedures for other purposes must have specific prior approval of the Administrator.

4.1 Single-Point, Grab Sampling and Analytical Procedure.

4.1.1 The sampling point in the duct shall either be at the centroid of the cross-section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

4.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. Leak-check the Orsas analyzer according to the procedure described in Section 5. This leak-check is mandatory.

FIGURE 5-3-SAMPUNG RATE DATA



4.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer. For emission rate correction factor determination, inunediately analyze the sample, as outlined in Sections 4.1.4 and 4.1.5, for percent O₀. If excess air is desired, proceed as follows: (1) immediately analyze the sample, as in Sections 4.1.4 and 4.1.5, for percent CO₀, O₀, and CO; (2) determine the percentage of the gas that is N₀ by subtracting the sum of the percent CO₀, percent O₀, and percent CO from 100 percent; and (3) calculate percent excess air as outlined in Section 6.2.

4.1.4 To insure complete absorption of the CO₁, O₂, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) she is be made between readings. (If consumt readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.1.5 After the analysis is completed, leak-check (mandstory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis.

Norm Since this single-point, grab sampling and analytical procedure in normally conducted in conjunction with a single-point, grab sampling and analytical procedure for a pollutant, only one analysis is ordinarily conducted. Therefore, great care must be taken to obtain a valid sample and analysis. Although in most cases only CO, or O, is required, it is recommended that both CO, and O, be measured, and that Section 4.4 be used to validate the analytical data.

4.2 Single-Point, Integrated Sampling and Analytical Procedure.

4.2.1 The sampling point in the duct shall be located as specified in Section 4.1.1.

4.2.2 Leak-check (mandatory) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (mandatory) the train by placing a vacuum gauge at the condenser inict, pulling a vacuum of a least 250 mm Hg (10 in. Hg.), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum shall remain stable for at least 0.5 minute. Evacuate the flexible bag, Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

4.2.3 Sample at a constant rate, or as specified by the Administrator. The sampling run must be simultaneous with and for the same total length of time as, the pollutant emission rate determination. Collect at least 30 liters (1.00 ft?) of sample gas. Smaller volumes may be collected, subject to approval of the Administrator.

4.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. For emission rate correction factor determination, analyze the sample within 4 hours after it is taken for percent CO, or percent O, (as outlined in Sections 4.2.5 through 4.2.7). The Orsat analyzer must be leak-check (see Section 5) before the analysis. If excess air is desired, proceed as follows: (1) within 4 hours after the sample is taken, analyze it (as in Sections 4.2.5 through 4.2.7) for percent CO,, O, and CC; (2) determine the percentage of the gas that is N, by subtracting the sum of the percent CO, percent O, and percent CO from 100 percent; (3) calculate percent excess air, as outlined in Section 6.2.

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EPA METHOD 10

DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

METEOS 19-DETERMINATION OF CARBON MONORING EMISSIONS PROM STATIONARY SOURCES

1. Principle and Applicability.

1.1 Principle. An integrate 1 or continuous gas sample is extracted from a sampling point and analyzed for ourbon monoxide (O) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 Applicability. This method is applicable for the determination of carbon monoside emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. Range and sensitivity.

2.1 Range 0 to 1,000 ppm.

2.2 Sewifitativ. Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span. 3. Interferences. Any substance caving a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (HaO) and carbon dioxide (CO₂) are 3.5 percent (HaO) per 7 ppm CO and 10 percent CO₂ per 10 ppm CO, respectively, for devices measuring in the 1.500 to 3,000 ppm range. For devices measuring in the 6 to 100 ppm range, interference ratios can be as high as 3.5 percent HaO per 25 ppm CO and 10 percent CO₂ per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. Precision and accuracy.

4.1 Precision. The precision of most NDIR analyzers is approximately ±2 percent of man.

4.2 Accuracy. The accuracy of most NDIR analyzers is approximately 25 percent of span after calibration.

5. Apperaise.

5.1 Continuous sample (Pigure 10-1).

5.1.1 Probe Stainless steel or sheathed Pyrex' glass, equipped with a filter to remove particulate matter. 5.1.2 Air-cooled condenser or equipment. To remove any excess moisure.

5.2 Integrated sample (Pigure 10-2).

5.2.1 Probe. Stainless steel or shouthed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 Air-cooled condenser or equivalent. To remove any excess moisture.

5.2.3 Value Needle valve, or equivalent, to to adjust flow rate.

5.2.4 Pump. Leak-tree disphraem type, or equivalent to transport gas.

5.2.3 Rate meter. Rotameter, or equivalent, to measure a flow range from 0 to 1.9 liter per min. (0.035 cfm).

5.2.6 Flerible bag. Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft.). Leak-test the bag in the laboratory before using by evacuating bag with a pump fol-

'Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

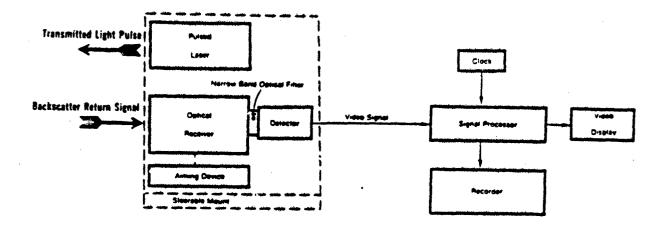


Figure AM1-VII. Functional Black Diagram of a Basic Lider System

owed by a dry gas tieter. When evacuation complete, there should be no flow brough the meter.

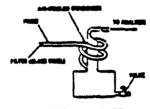
5.2.7 Pitot tube. Type S. or equivalent, atached to the probe so that the sampling ate can be regulated proportional to the tack me velocity when velocity is varying with the time or a sample traverse is conlucted

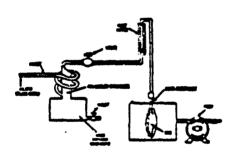
5.3 Analysis (Figure 10-3).

5.3.1 Carbon monoxide analyzer. Nondisservice infrared spectrometer, or equivalent. This instrument should be demonstrated. preferably by the manufacturer, to meet of exceed manufacturer's specifications and

hose described in this method.
5.3.2 Drying tube. To contain approxinately 200 g of Elion gel.
5.3.3 Calibration ges. Refer to paragraph

5.3.4 Filler. As recommended by NDIR nanufacturer.





5.3.5 CO, removal tube. To contain approximately 500 g of ascarite.
5.3.5 for water bath. For ascarite and silica

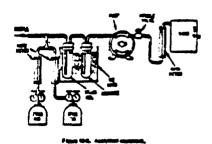
5.3.7 Value. Needle valve, or equivalent, to adjust flow rate

5.3.2 Rate meter. Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per ir (n. (0.035 c/m) through NDIL.

5.3.9 Recorder (optional). To provide permanent record of NDIR readings.

6. Zeggente.

6.1 Calibration passe. Enown concentra-tion of CO in nitrogen (No) for instrument spen, prepurified grade of Ne for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent apan. The span concentration shall not exceed 1.5 times the applicable source per-formance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.



6.2 Silice gel. Indicating type, 6 to 16 mesh, dried at 178° C (347° F) for 2 hours.

6.3 Ascerite Commercially available.

7. Procedure.

tube.

7.1 Sempline 7.1.1 Continuous sempling. Set up the equipment as shown in Figure 10-1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purpe the sampling line. Connect the anelyser and begin drawing sample into the an-alyser. Allow 5 minutes for the system to stabilise, then record the analyzer reading as required by the test procedure. (See 17.3 and 8). CO, content of the gas may be dete mined by using the Method 3 integrated sample procedure (36 PR 34886), or by weighing the ascertte CO, removal tube and computing CO, concentration from the gas volume sampled and the weight gain of the

7.1.2 Integrated sampling. Evacuate the Sexible beg. Set up the equipment as shown in Figure 10-2 with the bag discor Place the probe in the stack and purps the sampling line. Connect the beg, making sure that all connections are leak free. Sample at rate proportional to the stack velocity. CO, content of the gas may be determine by using the Method 3 integrated sample procedures (36 PR 24886), or by weighing the ascarite CO, removal tube and computing CO, concentration from the gas volume sampled and the weight gain of the tube.

7.2 CO Analysis Appe mble the apparatus as shown in Figure 18-3, calibrate the instrument, and perform other required operations as described in paragraph 1. Purps analyse with N₀ prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and sprn again after the test to assure that eny drift or malfunction is detected. Record the sample data on Table 18-1.

mble the apparatus se-8. Calibration, Assa cording to Figure 19-3. Generally an instrument requires a warm-up period before sta-bility is obtained. Pollow the manufactur-er's instructions for specific procedure. Allow a minimum time of I hour for warmup. During this time check the sample of ditioning apparatus, i.e., filter, conden drying tube, and CO, removal tube, sure that each compensat is in good op sting condition. Zero and calibrate the /sent according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

TABLE 10-	1—FIELD DATA
	Comments
Test.	-
Clark ting	Patameter estima, Kein per remes leades feel per remes)

2. Culou iniculation—Consentration of carbon rids. Calculate the concentration of wide to the stack using equa-

sub-contrastion of CO in stack, pum by volume (dry basis).

by NDLR analyses, ppus by volume (dry back)

relume fraction of CO, is sample, i.a., percent CO, from Orest analysis divided by 100.

18.1 McElrey, Frank. The Intertech MDIR-CO Analyser, Presented at 11th Methods Conference on Air Pollution, University of California, Bertoley, Calif., April

10.3 Jessin, M. R., et al., Continuous De-termination of Carbon Monoride and Hydrocarbons in Air by a Modified In-frared Analyser, J. Air Pollution Control Association, K2x 110-116, August 1986.

Association, NUC 119-110, August 1990.

10.3 MSA LIRA Infrared Gas and Liquid Analyser Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, Ph.

18.4 Models 215A, 315A, and 415A Infrared

Analyzers, Beckman Instruments, Inc., Beckman Instructions 1838-E. Puller-

ton, Calif., October 1967.

Continuous CO Monitoring System,
Medel A5611, Intertech Corp., Princeica, N.J.

10.6 UNOS. Infrared Ges Analysers, Bendix Corp., Romosverse, West Virgin-Analyzers,

ADDRIGA-A. PERFORMANCE SPECIFICATIONS FOR NOIR CARBON MONOXIDE ANALYZERS.

Mirango Caractella caractel	0-1000 ppcs. 0-1000, 30 ppcs.
St. Ann area, 50 persons (regal- reads. Fell 1, 2, 50 persons traps-	35 establish,
Trans. Ziny dell (manning)	10% in 8 hours.
Principle (married)	22% of M cont.
	CO1000 '9 1, M.O600 19 1.

B. Definitions of Performance Specifica-

Renoe-The minimum and maximum measurement limits

Output-Electrical signal which is proportional to the measurement; intunded for connection to re-dout or data processing devices Usually expressed as millivoits or milliamps full scale at a given impedance.

Full scale-The maximum measuring limit

for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approsches sero.

Accuracy—The degree of agreement te-tween a measured value and the true value:

usually expressed as ± percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument injet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval be-tween initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval pe-tween initial response time and time to 90 percent response after a step decrease in the

percent response start a step ustranse at arrivalet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation hours, of unadjusted continuous operation. when the input concentration is zero; usual-

ly expressed as percent full scale.

Spen Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement be-tween repeated measurements of the same concentration, expressed as the average de-

viation of the single results from the mean.

Noise—Spontaneous deviations from a
mean output not caused by input concentra-

tion changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

EPA METHOD 4

DETERMINATION OF MOISTURE CONTENT IN STACK GASES

METROS 4-DETERMINATION OF MOISTURE CONTENT IN STACK GASES

1. Principle and Applicability

1.1 Principle. A gas sample is extracted at a constant rate from the source; mousture is removed from the sample stream and determined either volumetrically or gravimetrically.

1.2 Applicability. This method is applicable for determining the moisture content of stack gas.

Two procedures are given. The first is a reference method, for accurate determinations of moisture content (such as are needed to calculate emission data). The second is an approximation method, which provides estimates of percent moisture to aid in setting isokinetic sampling rates prior to a pollutant emission measurement run. The approximation method described herein is only a suggested approach; alternative means for approximating the moisture content, e.g., crying tubes, wet bulb-dry bulb techniques, condensation techniques, stoichiometric calculations, previous experience, etc., are also acceptable.

The reference method is often conducted simultaneously with a pollutant emission measurement run; when it is, calculation of percent isokinetic, pollutant emission rate, etc., for the run shall be based upon the results of the reference method or its equivalent; these calculations shall not be based upon the results of the approximation method, unless the approximation method, unless the approximation method is shown, to the satisfaction of the Administrator. U.S. Environmental Protection Agency, to be capable of yielding results within 1 percent H₂O of the reference method.

North The reference method may yield questionable results when applied to saturated gas streams or to streams that contain water droplets. Therefore, when these conditions exist or are suspected, a second determination of the moisture content shall be made simultaneously with the reference method, as follows: Assume that the eas stream is saturated. Attach a temperature sensor (capable of measuring to m1' C (2' Fil to the reference method proce. Messure the stack gas temperature at each traverse point (see Section 2.2.1) during the reference method traverse; calculate the average stack gas temperature. Next, determine the mousture percentage, either by: (1) using a psychrometric chart and making appropriate corrections if stack pressure is different from that of the chart, or (2) using saturation vapor pressure tables. In cases where the pyschrometric chart or the saturation vapor pressure tables are not applicable (based on evaluation of the process), alternate methods, subject to the approval of the Administrator, shall be used.

2. Reference Method

The procedure described in Method 5 for determining moisture content is acceptable as a reference method.

2.1 Apparatus. A schematic of the sampling train used in this reference method is shown in Figure 4-1. All components shall be maintained and calibrated according to the procedure outlined in Method 5.

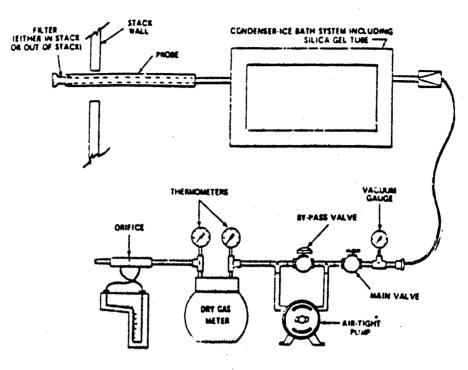


Figure 4-1. Maisture sampling train-retaining method

2.1.1 Probe. The probe is constructed of staniess steel or glass tubing, sufficiently heated to prevent water condensation, and is equipped with a filter, either in-stack (e.g., a plug of glass wool inserted into the end of the probe) or heated out-stack (e.g., as described in Method 5), to remove particular matter.

When stack conditions permit, other metals or plastic tubing may be used for the probe, subject to the approval of the Admin-

istrator.
2.1.2 Condenser. The condenser consists of four impingers connected in series with ground glass, leak-free fittings or any similarly leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified replacing the tip with a 1.3 centimeter (% inch) ID glass tube extending to about 1.3 cm (% in.) from the bottom of the flask The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator.

The first two impingers shall contain known volumes of water, the third shall be empty, and the fourth shall contain a known weight of 6 to 18-meah indicating type silica gel, or equivalent desiceant. If the silica gel has been previously used, dry at 175° C (356° F) for 2 hours. New silica gel may be used as received. A thermometer, capable of measuring temperature to within 1° C (2° F), shall be placed at the outlet of the fourth impinger, for monitoring purposes.

Alternatively, any system may be used (subject to the approval of the Administrator) that cools the sample gas stream and allows measurement of both the water that has been condensed and the moisture leaving the condensed, each to within 1 ml or 1 g. Acceptable means are to measure the condensed water, either gravimetrically or volumetrically, and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures, or (2) passing the sample gas stream through a tared silica gel (or equivalent desicoant) trap, with exit gases kept below 20° C (68° F), and determining the weight gain.

If means other than silics gel are used to determine the amount of moisture leaving the condenser, it is recommended that silics gel (or equivalent) still be used between the condenser system and pump, to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

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2.1.3 Cooling System. An ice bath coniner and crushed ice (or equivalent) are ied to aid in condensing moisture.

2.1.4 Metering System. This system inudes a vacuum gauge, leak-free pump, iermometers capable of measuring temperure to within 3° C (5.4° P), dry gas meter pable of measuring volume to within 2 ircent, and related equipment as shown in igure 4-1. Other metering systems, capable 'maintaining a constant sampling rate and itermining sample gas volume, may be ied, subject to the approval of the Admintrator.

2.1.5 Barometer. Mercury, aneroid, or her barometer capable of measuring atospheric pressure to within 2.5 mm Hg .1 in. Hg) may be used. In many cases, the irometric reading may be obtained from a rarby national weather service station, in hich case the station value (which is the solute barometric pressure) shall be rejested and an adjustment for elevation differences between the weather station and is sampling point shall be applied at a rate minus 2.5 mm Hg (0.1 in. Hg) per 30 m 00 ft) elevation increase or vice versa for evation decrease.

2.1.5 Graduated Cylinder and/or Balice. These items are used to measure connisted water and moisture caught in the lica get to within 1 ml or 0.5 g. Graduated 'dinders shall have subdivisions no greater ian 2 ml. Most laboratory balances are cable of weighing to the nearest 0.5 g or sa. These balances are suitable for use

2.2 Procedure. The following procedure is written for a condenser system (such as the impinger system described in Section 2.1.2) incorporating volumetric analysis to measure the condensed mousture, and silical sell and gravimetric analysis to measure the moisture leaving the condenser.

2.2.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine points shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used in all other cases. The traverse points shall be located according to Method i. The use of fewer soint; is subject to the approval of the Administrator, Select & suitable probe and probe length such that all traverse points can be sampled. Consider sampling from opposite sides of the stack (four total sampling ports) for large stacks, to permit use of shorter probe lengths. Mark the probe with heat revisiant tape or by some other method to denote the proper distance into the stack or duct for each sampling point. Place known volumes of water in the first two impingers. Weigh and record the weight of the silica gol to the nearest 0.5 g. and transfer the silica get to the fourth impinger, alternatively, the silica sel may first be transferred to the impinger, and the weight of the silica get plus impinger record2.2.2 Select a total sampling time such that a minimum total gas volume of 0.60 scm (21 scf) will be collected, at a rate no greater than 0.021 m/min (0.75 cfm). When both mossure content and pollutant emission race are to be determined, the mousture determination shall be simultaneous with, and for the same total length of time as, the pollutant emission rate run, unless otherwise specified in an applicable subpart of the standards.

2.2.3 Set up the sampling train as shown in Figure 4-1. Turn on the probe heater and (if applicable) the filter heating system to temperatures of about 120° C (248° F), to prevent water condensation ahead of the condenser, allow time for the temperatures to stabilize. Place crushed ice in the ice bath container. It is recommended, but not required, that a leak check be done, as follows: Disconnect the probe from the first impinger or (if applicable) from the filter holder. Plug the inlet to the first impinger (or filter holder) and pull a 380 mm (15 in.) Hg vacuum: a lower vacuum may be used, provided that it is not exceeded during the test. A leakage rate in excess of 4 percent of the average mampling rate or 0.00057 m4/min (0.02 cfm), whichever is less, is unacceptable. Pollowing the leak check, reconnect the probe to the maipling train.

2.2.4 During the sampling run, maintain a sampling rate within 10 percent of constant rate, or as specified by the Administrator. For each run, record the data re-

FIGURE 4-2-FIELD MOISTURE DETERMINATION REFERENCE METHOD

1	
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PMS	
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OTIONS PIOCESTO	
de length in (R)	
\	

SCHEMATIC OF STACE CACON SECTION

were son nother	Secretary total	Stack temperature	Progue differential			Gas Sartute terre		Yempershareth of gas income consoner or
			meter AM	sample volume		PROG.	Chart	leds orderight
	(d), max.	rs (P)	mm (m.) M.O	m' #7	m (A)	וחשיבוח	me were	PD 5
					Ave	Avg	Acres.	

quired on the example data sheet shown in Figure 4-2. Be sure to record the dry gas meter reading at the beginning and end of each sampling time increment and whenever sampling is halted. Take other appropriate readings at each sample point, at least once during each time increment.

2.2.5 To begin sampling, position the probe tip at the first traverse point. Immediately start the pump and adjust the flow to the desired rate. Traverse the cross section, sampling at each traverse point for an equal length of time. Add more ice and, if no ressary, sait to maintain a temperature of less 20° C (68° F) at the silica gel outlet.

2.2.6 After collecting the sample, disconnect the probe from the filter holder (or from the first impunger) and conduct a leak check (mandatory) as described in Section 2.2.3. Record the leak rate. If the leakage rate exceeds the allowable rate, the tester shall either reject the test results or shall correct the sample volume as in Section 6.3 of Method 5. Next, measure the volume of the mouture condensed to the nearest mi. Determine the increase in weight of the silica gel (or silica gel plus impinger) to the nearest 0.5 g. Record this information (see example data sheet. Figure 4-3) and calcuis to the mouture percentage, as described in

2.2.7 A quality control check of the volume metering system at the field site is suggested before collecting the sample following the procedure in Method 5. Section

2.3 Calculations. Carry out the following calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calcula-

FIGURE 4-3-ANALYTICAL DATA-PEFERENCE METHOD

	imonger volume, 19	Sica ger wagnt g
Fre		1
Ofference		

2.3.1 Nomenciature.

B ... Proportion of water vapor, by volume. in the gas stream.

M .- Molecular weight of water, 18.0 g/gmoie (18.0 lb/lb-moie).

P.=Absolute pressure (for this method, same as barometric pressure; at the dry gas meter, man Hg (in. Hg).

P - Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R-Ideal gas constant, 0.06236 (mm Hg) (mⁿ/(g-mole) ('K) for metric units and 21.55 (in. Hg) (ft²)/(lb-mole) ('R) for English units.

T .- Absolute 'emperature at meter, 'K

Tax = Standard absolute temperature, 293 K (528°R).

 V_x =Dry gas volume measured by dry gas meter, dem (def).

4 V. = Incremental dry gas volume measured by dry mas meter at each traverse point. dem (act).

V____Dry gas volume measured by the dry as meter, corrected to standard conditions, decra (decr),

www.=Volume of water vapor condensed corrected to standard conditions, som (set).

... Volume of water vapor collected in silica gel corrected to standard conditions sem (sef).

V. Final volume of condenser water, mi.

V .- Initial volume, if any, of condenser water, ml.

W .- Final weight of silica gel or silica gel plus impinger, g.

-Initial weight of silica gel or silica gel plus impinger, g.

Y - Dry gas meter calibration factor.

Density of water, 0.9982 g/mi (0.002201 ib/ml).

Volume of water vapor .. andensed

 $= K_i(V_i - V_i)$

Equation 4-1 where:

K,=0.001333 m*/mi for metric units =0.04707 ft /ml for English units

2.3.3 Volume of water vapor collected in silics sel.

KIW- WA

Equation 4-2 where

 $K_s=0.001335$ m $^{4/}$ g for metric units =0.04715 ft*/g for English units 2.3.4 Sample gas volume.

$$V_{mangle} = V_m Y = \frac{(P_m)(T_{mil})}{(P_{mil})(T_m)}$$

Equation 4-3

where:

K,=0.3858 'K/mm Hg for metric units =17.64 'B/in. Hg for English units

Now If the post-test lead rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_{-} in Equation 4-5, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

Equation 4-4

Nore in saturated or moisture dropletladen gas streams, two calculations of the moisture content of the stack yas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of de "hall be considered correct.

2.3.6 Verification of constant sampling rate. For each time increment, determine the AV ... Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results and repeat the run.

1 Approximation Method

The approximation method described below is presented only as a suggested method (see Section 1.2).

3.1 Apparatus.

3.1.1 Probe. d. ainless steel glass tubing, sufficiently heated to prevent water condensation and equipped with a filter (either instack or heated out-stack) to remove particuli te matter. A pluz of glass wool, inserted into the end of the probe, is a satisfactory filter.

3.1.2 Impingers. Two midget impingers. each with 30 ml capacity, or equivalent.

1.1.3 Ice Bath. Container and ice, to aid in condensing moisture in impingers.

3.1.4 Drying Tube. Tube packed with new or regenerated 6- to 16-mesh indicatingtype silica gel (or equivalent desiccant), to dry the sample gas and to protect the meter and pump.

3.1.5 Valve, Needle valve, to regulate the

sample gas flow rate.
3.1.3 Pump. Leak-free, disphragm type. equivalent, to pull the gas sample through the train.

3.1.7 Volume Meter. Dry gas meter, sum-ciently socurate to measure the sample Volume Meter, Dry ras meter, suffivolume within 2%, and calibrated over the range of flow rates and conditions actually encountered during sampling.

114 Rate Meter, Rotameter, to measure the flow range from 0 to 3 lpm (0 to 0.11

cfm).

1.1.9 Graduated Cylinder. 25 ml.

3.1.10 Barometer, Mercury, aneroid, or other barometer, as described in Section 2.1.5 above.

J.1.11 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for the same pling leak check.

3.2 Procedure.

3.2.1 Place exactly 5 ml distilled water in each impinger.

Leak check the sampling train as follows: Temporarily insert a vacuum gauge at or near the probe inlet: then, plug the probe injet and pull a vacuum of at least 250 mm Hg (10 in. Hg). Note, the time rate of change of the dry gas meter dial; alterna-tively, a rotameter (0-40 cc/min) may be temporarily attached to the dry gas meter outlet to determine the leakage rate. A leak rate not in excess of 2 percent of the average sampling rate is acceptable.

NOTE Carefully release the probe inlet plus before turning off the pump.

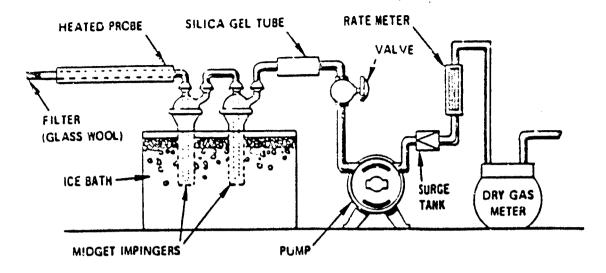


Figure 4-4. Moisture-sampling train - approximation method.

PIGURE 4-5-- FIELD MOISTURE DETERMINATION-APPROXIMATION METHOS

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3.2.2 Connect the probe, insert it into the stack, and sample at a or istant rate of 2 lpm (0.071 cfm). Continue sampling until the dry gas meter registers about 30 liters (1.1 ft?) or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by

Figure 4-8.

J.2.3 After collecting the sample, combine the contents of the two impingers and

measure the volume to the nearest 0.5 ml.
3.3 Calculations. The calculation method presented is designed to estimate the moisture in the stack gas: therefore, other data, which are only necessary for accurate moisture determinations, are not collected. The following equations adequately estimate the moisture content, for the purpose of determining isokinetic sampling rate settings.

3.3.1 Nomenciature.

Sam - Approximate proportion, by volume. of water vapor in the gas stream leaving the second impinger, 0.025.

-- Water vapor in the gas stream, propor-

tion by volume.

M.=Molemiar weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

Pa=Absolute pressure (for this method, same as barometric pressure) at the dry ELS AIGUET.

Por - Standard absolute pressure, 760 mm Hg (29.92 In. Hg).

R=Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) ('K) for metric linits and 21.85 (in. Hg) (ft')/lb-mole) ('R) for English units

V - Final volume of impinger contents, ml.

V . Initial volume of impinger contents mi.

V.-Dry gas volume measured by dry gas meter, dem (def).

Vous Dry gas volume measured by dry gas meter, corrected to standard conditions, deem (decf).

per = Volume of water vapor condensed, corrected to standard conditions, some (scf).

A-Density of water, 0.2982 g/ml (0.002201 lb/mll.

Y = Dry gas meter calibration factor.

3.3.2 Volume of water vapur collected. where:

$$V_{ac} = \frac{(V_j - V_i)\beta_{ac}AT_{acc}}{P_{acc}M_0}$$

K, (V/- 41)

Equation 4-5 K.=0.001333 m*/mi for metric units =0.04707 ft*/ml for English units. 3.3.3 Gas volume.

$$\begin{split} V_{m \text{ (odd)}} &= V_{m} \left(\frac{P_{m}}{P_{\text{odd}}}\right) \left(\frac{T_{\text{odd}}}{T_{m}}\right) \\ &\approx K_{1} \frac{V_{m}P_{m}}{T_{m}^{-1}} \end{split}$$

Figuration 4-4

Where:

L=0.3858 'K/mm Es for metric unit =17.64 'R/in. Hg for English units
33.4 Approximate moisture conte

$$B_{re} = \frac{V_{re}}{V_{re} + V_{m \, torol}} + B_{re}$$

$$= \frac{V_{re}}{V_{re} + V_{m \, torol}} + ($$
Equation

4. Calibration

4.1 For the reference method, ca equipment as specified in the follows tions of Method 5: Section 5.3 (me and Section 5.5 (temperature grand Section 5.7 (barometer). The mended leak check of the metering: (Section 5.6 of Method 5) also applies reference method. For the approxit methor, use the procedures outlined i tion s....l of Method 6 to calibrate th tering system, and the procedure of h 5. Section 5.7 to calibrate the baromet 1. Bibliography

1. Air Pollution Engineering & (Second Edition). Danielson, J. A. (ed. Environmental Protection Agency, Of Air Quality Planning and Standard search Triangle Park, N.C. Publication AP-40, 1973.

2. Devorkin. Howard et al. Air Pol Source Testing Manual. Air Pollution trei District, Los Angeles, Calif. Nove

1. Methods for Determination of Ve Volume Dust and Mist Content of Western Precipitation Division of Joy ufacturing Co., Los Angeles, Calif. Be WP-50. 1907.

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EPA WIPE SAMPLING TECHNIQUE

SECTION 13 SPECIALIZED SAMPLING TECHNIQUES

13.0 GENERAL

This section discusses several specialized sampling techniques that have been used by contractors on hazardous waste sites. The reader may develop other techniques for specific site needs. In those cases and in cases where the techniques listed here are modified for use on a specific site, careful documentation of the exact procedures used should be provided. This section does not discuss analytical techniques, since analytical methods would vary depending on the data quality objectives, the compounds of concern, the media, and the exact sampling technique. The Contract Laboratory Program plans to issue a "Field Methodology Catalog" in the summer of 1987 that will contain field analytical techniques suitable for analyses of the samples collected by using the techniques in this section.

13.1 WIPE SAMPLING

13.1.1 Scope and Purpose

This quideline discusses the steps required for obtaining a wipe sample. Wipe samples may be used to document the presence of carcinogenic substances or other toxic materials. In addition, wipe sampling is commonly used to ascertain that site or equipment decontamination has been acceptably effective.

13.1.2 Definitions

Site Manager (SM)

The individual responsible for the successful completion of a work assignment within budget and schedule. This person is also referred to as the Site Project Manager or the Project Manager and is typically a contractor's employee (see Subsection 1.1).

Wipe Sample

このいろのは、大きなが、このが、中国できるのはないないできる。 まないとなるのでは、大きなで

A sample used to assess surface contamination. The terms "wipe sample," "swipe sample," and "smear sample" have all been used synonymously. For purposes of this section, the sample will be termed "wipe sample."

13.1.3 Applicability

This guideline is applicable when a sample of the substances on a surface is needed. Surfaces may ingive walls, floors, cellings, desk tops, equipment, or other large objects that are potentially contaminated.

13.1.1 Responsibilities

The SM or designee is responsible for deciding when wice sampling is needed.

Field personnel are responsible for performing the actual sampling, maintaining sample integrity, and preparing the proper chain-of-custody forms.

13.1.5 Records

Records of wipe sampling include completed chain-of-custody forms and appropriate entries in the field logbook. If the sample collected is to be analyzed using the National Contract Laboratory Program (CLP), then CLP forms must be completed as discussed in Section 5.

13.1.6 Procedures

Wipe sampling can be an integral part of the overall sampling program. Wipe sampling can help to provide a picture of contaminants that exist on the surface of drums, tanks, equipment, or buildings on a hazardous waste site or that exist in the homes of a populace at risk.

Wipe sampling consists of rubbing a moistened filter paper over a measured area of 100 cm² to 1 m². The paper is then sent to the laboratory for analysis. The results are related back to the known area of the sample. A proper sampling procedure is essential to ensure a representative, uncontaminated sample.

13.1.6.1 Equipment Required

The following equipment is needed for wipe sampling:

- Whatman 541 filter paper or equivalent, 15 cm
- Disposable, chemical-protective gloves
- Solvent to wet filter paper

13.1.6.2 Wipe Sampling Steps

The steps involved in obtaining a wipe sample are listed below:

- Using a clean, impervious disposable glove, such as a surgeon's glove, remove a filter paper from
 the box. (Note: Although it is necessary to change the glove if it touches the surface being wiped,
 a new glove should be used for each sample to avoid cross contamination of samples. A new
 glove should always be used when collecting a new sample.)
- Moisten the filter with a collection medium selected to dissolve the contaminants of concern as specified in the sampling plan. Typically, organic-free water or the solvent used in analysis is used. The filter should be wet but not dripping.
- Thoroughly wipe approximately 1 m² of the area with the moistened filter. Using a 1 m² stencil will help in judging the size of the wipe area. If a different size area is wiped, record the change in the field logbook. If the surface is not flat, be sure to wipe any crevices or depressions.

- Without allowing the filter to contact any other surface, fold it with the exposed side in, and then
 fold it over to form a 90-degree angle in the center of the filter.
- Place the filter (angle first) into a clean glass jar, replace the top, seal the jar according to quality
 assurance requirements, and send the sample to the appropriate laboratory.
- Prepare a blank by moistening a filter with the collection medium. Place the blank in a separate jar, and submit it with the other samples.
- Document the sample collection in the field logbook and on appropriate forms, and ship samples
 per procedures listed in Section 6.

13.1.7 Region-Specific Variances

No region-specific variances have been identified; however, all future variances will be incorporated in subsequent revision to this compendium. Information on variances may become dated rapidly. Thus, users should contact the regional EPA RPM for full details on current regional practices and requirements.

13.1.8 Information Sources

EBASCO, "Dioxin Sampling," *REM III Program Guidelines*. Prepared for U.S. Environmental Protection Agency. 28 February 1986.

NUS Corporation. "Site-Specific Site Operations Plans." REM/FIT Contract.

13.2 HUMAN HABITATION SAMPLING

13.2.1 Scope and Purpose

This subsection provides general guidance for the planning, method selection, and implementation of sampling activities used to determine the potential for human exposure to contaminants that are present in residential environment.

13.2.2 Definitions

Human Habitation Areas

Any place people may spend extended periods of time, such as their homes or offices.

13.2.3 Applicability

This subsection discusses sampling techniques that are similar in collection methodology to other types of samples, such as environmental soil and water, but are biased to emphasize potential human exposure to contaminants moving into the residential environment.

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MODIFIED METHOD I.W02

ANALYSIS OF EXPLOSIVES IN SOIL, WIPE, AND RINSATE SAMPLES

ANALYSIS OF EXPLOSIVES IN SOIL, WIPE, AND RINSATE SAMPLES

I. SUMMARY

A. Analytes:

XMH Cctahydro-1,3,5,7-tetranitro-1,3,5,7tetrazocine RDX Hexahydro-1,3,5-trinitro-s-triazine NB Nitrobenzene 1.3-DNB 1,3-Dinitrobenzene 1,3,5-TNB 1,3,5-Trinitrobenzene 2,4-DNT 2,4-Dinitrotoluene 2,6-Dinitrotoluene 2,6-DNT 2,4,6-TNT 2,4,6-Trinitrotoluene Tetryl 2,4,5-Trinitrophenylmethylnitramine

- B. Matrix: Extracts from soil, wipe, or rinsate samples.
- C. General Method: Sample matrix is extracted with acetonitrile. The extract is diluted with methanol and water, and the resultant solution is injected onto the HPLC for analysis.
- D. This method is based on USATHAMA Method LW02, Explosives in Soil.

II. SAFETY INFORMATION

Work in well ventilated areas. Wear adequate protective clothing to avoid skin contact. Wash skin with soap and water thoroughly immediately after contact.

TNB, HMX, RDX, Tetryl, and TNTs are classified as Explosives A by DOT. Avoid extreme temperatures and pressures.

III. APPARATUS AND CHEMICALS

A. Glassware/Hardware

- 1. Syringes: 10 uL, 50 uL, 100 uL, 1 mL syringe (Hamilton 1005 TEFLL).
- Vials with teflon-lined caps or septa. Nominal volume of 1.8 mL, 4.0 mL, and 12 mL.
- B-D Glaspak disposable syringes, 5 mL, with frosted tip.
- 4. 0.2 micron fluorocarbon filters.

- 5. Micropipettes, 200 uL.
- 6. Hypo needles.
- 7. 2 mL and 20 mL pipette.
- 8. Whatman #42 ashless 9 cm filter paper.

B. Instrumentation

1. Perkin-Elmer Series 4 High Performance Liquid Chromatograph (HPLC) equipped with a Perkin-Elmer ISS100 Auto-Injector and Micromeritrics Model 786 UV/VIS variable wavelength detector. Hewlett-Packard 3390 recording integrator in peak height mode was used to record data output. Equivalent instrumentation may be substituted.

2. Analytical Balance

Capable of weighing 0.01 gram for sample preparation and 0.1 mg for standard preparation. Mettler AE 163 or equivalent.

3. Parameters

- a. Columns:
 - 1) DuPont Zorbax $^{\rm R}$ ODS 4.6 mm i.d. x 25 cm HPLC column with a particle size of 5 to 6 microns.
 - 2) DuPont Permaphase R ODS guard column (optional).
- b. Mobile Phase:

50% water 34% methanol 16% acetonitrile

- c. Flow: 1.6 mL/min with a pressure of approximately 2860 psig.
- d. Detector: 250 nm
- e. Injection Volume: 50 uL

C. Reagents and SARMs:

1. Acetonitrile, distilled in glass for HPLC use.

- 2. Methanol, distilled in glass for HPLC use.
- 3. Water, distilled in glass for HPLC use.
- 4. USATHAMA Standard Soil.
- 5. SARMS

HMX SARM No. 1217 (PA 1303)
RDX SARM No. 1130 (PA 1302)
NB SARM No. (PA 1306)
1,3-DNB SARM No. 2250 (PA 1305)
1,3,5-TNB SARM No. 1154 (PA 1300)
2,4-DNT SARM No. 1147 (PA 1298)
2,6-DNT SARM No. 1148 (PA 1299)
2,4,6-TNT SARM No. 1129 (PA 1297)
Tetryl SARM No. 1149 (PA 1301)

IV. CALIBRATION

- A. Initial Calibration
 - 1. Preparation of Standards
 - a. Stock calibration solutions containing approximately 10,000 mg/L of a nitro-compound are prepared by accurately weighing ca. 50 mg of a SARM into a 5-mL serum bottle and dissolving the nitro-compound in 5 mL of acetonitrile pipetted into the bottle. All stock solutions prepared in this manner and stored in a freezer (0°C to -4°C) have remained stable for a period of 6 months.
 - b. Intermediate Calibration Standards: All compounds appear to be stable for at least 3 months.
 - 1) Intermediate Calibration Standard A (high level): Combine the appropriate volumes of stock calibration standard as shown below. Dilute to 10 mL with acetonitrile and seal with a teflonlined cap. Store in the dark at 4°C. The resulting solution will have the concentrations indicated in the following table.

Nitro-compound	uL of Stock Cal Std.	Resulting Concentration (ug/mL)
нмх	127	127
RDX	98	98
NB	42	42
1,3-DNB	59	59
1,3,5-TNB	209	209
2,4-DNT	42	42
2,6-DNT	40	40
2,4,6-TNT	192	192
Tetryl	500	500

2) Intermediate Calibration Standard B (low level): 1:10 dilution of the Intermediate Calibration Standard A is made in acetonitrile. Seal with a teflon-lined cap and store in the dark at 4°C. The resulting solution will have the following concentrations:

Nitro-compound	Resulting conc
HMX	12.7
RDX	9.80
ИВ	4.20
1,3-DNB	5.90
1,3,5-TNB	20.9
2,4-DNT	4.20
2,6-DNT	4.00
2,4,6-INT	19.2
Tetrvl	50.0

c. Working Calibration Standards: Using the following table, prepare a series of nine calibration standards. Place the mobile phase into a 1-mL serum vial. Inject the indicated volumes of Intermediate Calibration Standard A or B into the acetonitrile with a microliter syringe. Seal the vial with a teflon-lined septum and cap. Mix well. These solutions are prepared fresh daily and kept in the dark.

WORKING CALIBRATION STANDARDS

Concentration	Intermediate Cal Std A (uL)	Intermediate Cal Std B(uL)	Mobile Phase
0X	0	0	1,000
0.5 X	-	6.25	994
1X		12.5	988
2 X	_	25	975
5X	-	62.5	938
10 X	12.5	-	988
20X	25	•	975
50X	62.5	-	938
100X	125	-	875

2. Daily Calibration

- a. Set up the instrument according to Section IV, Instrumental Analysis.
- b. Analyze mobile phase as a blank to verify a stable baseline.
- c. Analyze the medium calibration standard (10%) to verify peak separation and retention times.
- d. Analyze the calibration standards prepared in Section IV-A-1.

3. Analysis of Calibration Data

- a. Tabulate the calibration standard concentration versus the peak height response for each calibration standard.
- b. Parform a linear regression analysis on the calibration data plotting peak height vs. concentration in ug/mL.
- c. Use the liner regression to obtain analyte concentration for sample response.

4. Calibration Checks

a calibration standard at the 10% concentration is analyzed. The response must agree within 25 percent with the daily calibration 10% standard.

b. No certified calibration check standards are available for these compounds.

V. SAMPLE HANDLING STORAGE FOR SOIL, WIPE, AND RINSATE SAMPLES

- A. Sampling Procedure: The stability of explosives in soil is not truly known. Precautions should be taken to avoid prolonged exposure to light and heat.
- B. Containers: Wide-mouth amber glass bottles with teflon-lined lids.
- C. Storage Conditions: Samples should be maintained at 4°C from the time of collection to the time of analysis. No chemical preservatives are necessary.
- D. Holding Time Limits: 7 days to extraction; 40 days to analysis from the time of extraction.
- E. Solution Verification: No certified check standards are available.

VI PROCEDURE

A. Soil Analysis

1. Method

- a. Accurately weigh 1 gm of soil into a 5-mL serum vial and pipet 2 mL of acetonitrile onto the soil.
- b. Place a septum and cap on the vial and shake the vial thoroughly by hand for 2 to 3 minutes.
- c. The extract is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluorocarbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC.
- d. Preparation of sample extracts and spikes for injection is performed the day of analysis.

- i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.
- ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

Daily Quality Control

- a. Perform a spike at 10X the detection limit daily as follows.
 - i. Accurately weight approximately 1 gm of USATHAMA standard soil into a 5-mL serum vial.
 - ii. Spike with 100 uL Standard A.
 - iii. Proceed as in VI-A-1, above.

3. Instrumental Analysis

a. Proceed to Section VII, Instrumental Analysis. The working range for soil samples is listed below.

Calibration Range for Soil Analysis (1X - 100X)

HMX	1.27 - 127	ug
RDX	0.98 - 98.0	ug
NB	0.42 - 42.0	ug
1,3-DNB	0.59 - 59.0	ug
1,3,5-TNB	2.09 - 209	ug
2,4-DNT	0.42 - 42.0	ug
2,6-DNT	0.40 - 40.0	ug
2,4,6-TNT	1.92 - 192	ug
Tetryl	5.00 - 500	ug

b. Samples with analyte concentration exceeding the calibration range will require dilution as necessary.

B. Wipe Analysis

1. Method

- a. Add the filter to a 40-mL vial and pipet 20 mL acetonitrile into the vial.
- b. Place a cap on the vial and shake the vial thoroughly by hand for 2 to 3 minutes.
- c. The extract is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a flurocarbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC. The remaining extract is disposed as waste.
- d. Preparation of sample extracts and spikes for injection is performed the day of analysis.
 - i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.
 - ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.

2. Daily Quality Control

- a. Perform a spike at 10% the detection limit daily as follows.
 - Place 1/10 of a filter paper into a 5-mL serum vial.
 - ii. Add 2 mL acetronitrile.
 - iii. Spike with 100 uL Standard A.
 - iv. Proceed as in VI-B-1-b, above.

3. Instrumental Analysis

a. Proceed to Section VII, Instrumental Analysis. The working range for wipe samples is listed below.

Calibration Pange for Wipe Samples

HMX	12.7 - 1270	total ug/wipe
RDX	9.8 - 980	total ug/wipe
NB ·	4.2 - 420	total ug/wipe
1,3-DNB	5.9 - 590	total ug/wipe
1,3,5-TNB	20.9 - 2090	total ug/wipe
2,4-DNT	4.2 - 420	total ug/wipe
2,6-DNT	4.0 - 400	total ug/wipe
2,4,6-TNT	19.2 - 1920	total ug/wipe
Tetryl	50.0 - 5000	total ug/wipe

b. Samples with analyte concentration exceeding the calibration range will require dilation as necessary.

C. Rinsate Analysis

1. Method

- a. Acetonitrile rinsate is collected from equipment.
- b. Measure volume of rinsate.
- c. The rinsate is then filtered using the following technique. A 5-mL syringe is fitted with a needle. After the extract is drawn into the syringe barrel, a fluorocarbon 0.2 micron disposable filter is attached in place of the needle. The sample is then slowly forced through the filter into a 4-mL teflon-capped vial and stored until the extract is diluted and analyzed by HPLC. The remaining rinsate is disposed as waste.
- d. Preparation of sample extracts for injection is performed the day of analysis.
 - i. Using a disposable micropipette, accurately measure 200 uL of filtered extract into a 1-mL vial. Accurately measure 600 uL of a 33 percent methanol/67 percent water solution onto the filtered sample. This will produce 800 uL of extracted sample in mobile phase.

- ii. Place a septum cap on the vial. Shake the vial well to thoroughly mix. Store in the dark at 4°C until ready to analyze.
- 2. Daily Quality Control
 - a. Perform a spike at 10X the detection limit daily as follows:
 - i. Add 2 mL acetonitrile to a 5-mL serum bottle.
 - ii. Spike with 100 uL of Standard A.
 - iii. Proceed as in VI-C-1-c.
- 3. Instrumental Analysis
 - a. Proceed to Section VII, Instrumental Analysis. The working range for rinsate samples is described below.

Calibration Range for Rinsate Samples

HMX	0.635 - 63.5	total mg/sample
RDX	0.49 - 49.0	total mg/sample
NB	0.21 - 21.0	total mg/sample
1,3-DNB	0.295 - 29.5	total mg/sample
1,3,5-TNB	1.05 - 105	total mg/sample
2,4-DNT	0.21 - 21.0	total mg/sample
2,6-DNT	0.20 - 20.0	total mg/sample
2,4,6-TNT	0.96 - 96.0	total mg/sample
Tetryl	2.50 ~ 250	total mg/sample

b. Samples with analyte concentration exceeding the calibration range will require dilation as necessary.

VII. INSTRUMENTAL ANALYSIS

A. Set the chromatographic conditions as follows:

	Time (minutes)		Acetonitrile (percent)		Water (Percent)
Equilibrium	3	1.6	16	34	50
Analysis Run	1 15		16	34	50

B. Using the auto-injector manufacturer's recommended procedure, introduce 50 uL of the medium level calibration standard into the chromatographic system.

Check the chromatogram to ensure separation of the nitrated toluenes and separation of the nitrobenzene and tetryl. If necessary, adjust the water/methanol ratio of the mobile phase until separate peaks are distinguished. As the column ages, less methanol is required. Generally, the column ages rapidly the first 24 hours, after which it is fairly stable.

C. Once good peak separation is obtained, introduce 50 uL of each working calibration standard and sample into the chromatographic system using the auto-injector manufacturer's recommended procedure.

VIII. CALCULATIONS

- A. Soil Samples
 - 1. The diluted extract concentration is read or calculated from the instrument calibration curve.
 - 2. Sample concentration (ug/g) = $\frac{B \times D}{A \times C}$

extract conc (ug/mL) x 4 x B

A

where:

A = sample weight (dry weight)

B = mL acetonitrile

B. Wipe Samples

Sample Concentration (total ug) = extract conc (ug/mL) x 20 mL x 4

where:

20 mL = total volume

4 = dilution in method

C. Rinse

Sample concentration (total ug) = extract conc (ug/mL) x V x 4

where:

V - total volume

4 - dilution in method

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MODIFIED METHOD FOR NITROCELLULOSE, NITROGLYCERIN, AND PETN IN WATER

MODIFIED METHOD OF NITROCELLULOSE, NITROGLYCERIN, AND PETN IN WATER

1. APPLICATION

This method is used to qualitatively determine the concentration of nitrocellulose (NC), nitroglycerine (NC), and PETN in water samples.

- A. <u>Tested Concentration Range</u> Response is linear from 5 to 100 mg/liter in water.
- B. Sensitivity Limits Response for 5 ug of compound is: NC = 0.89, NG = 0.17, PETN = 0.15 absorbance units.
- C. <u>Detection Limits</u> -

Compound	Water (ug/L)
NC	9000
NG	5000
PETN	5000

- D. <u>Interferences</u> Nitrite ion will interfere, NC, NG, and PETN cannot be distinguished from each other.
- E. Analysis Rate Approximately 20 samples can be analyzed by one worker in an eight hour day.

2. CHEMISTRY:

Nitrite ion is cleaved from the nitrate ester in basic solution, which diazotizes procaine, in acidic solution, which in turn couples with N, N-dimethyl-1-naphthylamine to produce an azo-dye. This dye is determined from its absorbance at 510 um.

C₃N₃N₃O₉ - Trinitroglycerine; glyceryl trinitrate; CAS RN-55-63-0 mp - 13°C, decomposition pt = 145°C;

 $C_5 N_8 N_6 O_{12}$ - Pentaerythritol tetranitrate CAS RN-78-11-5 mp - 140°C; explosive decomposition pt. 210°C;

 $(C_6N_{12}N_5O_{16})x$ - nitrocellulose, soluble gun cotton, CAS RN-9004-70-0 mp - decomposes on heating.

Handling Hazards: Explosives hazard, avoid heat, shock or open flame. Toxic inhalation and skin absorption hazards exist. Do not handle NG except as a dilute solution.

1248E

3. APPARATUS:

- A. <u>Instrumentation</u> Absorbance measurements are made at 510 nm on a Perkin Elmer Lambda 3 UV/UVS spectrometer equipped with a super sipper.
- B. Parameters N/A

C. Hardware/Glassware

- 1) 0.1-, 1-, and 2-mL
- 2) 13 x 100 nm glass test tubes
- 3) 10-mL volumetric flasks
- 4) 100-mL volumetric flasks
- 5) 1-cm spectrometer call (glass)
- 6) water bath
- 7) hot plate
- 8) 25-uL graduated syringe
- 9) 8-ounce glass bottle
- 10) 2 dram glass vials

D. Chemicals

- 1) KOH, Analytical reagent grade
- 2) Glacial acetic acid, ACS grade
- 3) Acetone, ACS grade
- 4) N, N-dimethyl-l-naphthylamine
- 5) Procaine

E. Reagents

- 1) 10 percent KOH: Weigh 10.0 g of reagent grade potassium hydroxide into a 100-mL volumetric flask and dilute slowly with deionized water (nitrite free).
- 2) 20 percent KOH: Same as above except use 20.0 g of KOH.
- 3) 10 percent acetic acid: Pipette 10.0 mL of glacial acetic acid into a 100-mL volumetric flask that is partially filled with deionized water (nitrite free). Dilute of volume with deionized water.
- 4) 50 percent acetic acid: Same as above except use 50 mL of glacial acetic acid.
- 5) Color Developing Reagent: Weigh 0.35 g each of procaine and N,N-dimethyl-1-naphthylamine into a 100-mL volumetric flask and dilute to volume with 50 percent acetic acid-water.

6) Working Solution of Color Reagent: Pipette 20 mJ, of the color developing reagent into a 100-mL volumetric flask. Dilute to volume with deionized water (nitrite free).

4. STANDARDS

A. Calibration Standards

- 1) Stock Weigh 10.0 mg of NC, PETN, or 1 mL of a 1 percent NC in acetone SARM into a 10.0-mL volumetric flask and dilute to volume with acetone to obtain a 1 ug/ul solution. This solution is refrigerated when not in use.
- Working Prepare standard curve daily by adding 0.0, 2.5, 5, 10, 25, and 50 uL of 1 ug/uL stock solution, in duplicate, into 13 mm by 100 mm test tubes, using a 25-uL syringe. Add 0.5 mL of deionized water to each tube and mix thoroughly. This yields concentrations of 0, 5, 10, 20, 50, and 100 ug/mL.
- B. <u>Control Spikes</u> For water samples spike as indicated for the working standards.

5. PROCEDURE:

A. Water Sample Handling/Preparation - Refrigerate the samples until ready for analysis. Prior to analysis, filter through a 0.45 micron Millipore filter and store refrigerated in a 2 dram glass vial.

B. Analysis of Samples

- la) <u>Water</u> Pipette 0.50 mL of water into a 13 x 100 mm test tube and add 0.50 mL of 20 percent potassium hydroxide solution.
- b) Soil 5 g of air-dried soil is shaken with 5 mL of acetone. The acetone is separated by filtration through a 0.45 u membrane filter (teflon). A 0.5-mL portion of the acetone solution is mixed with 0.5 mL of water and 0.5 mL of 20 percent potassium hydroxide solution.
- 2) Mix sample well and place in boiling water bath for 30 minutes.
- 3) Cool the sample; add 2.0 mL of 10 percent acetic acid, and mix.
- 4) Add 1.0 mL of color developing reagent working solution and mix well.

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5) Allow color to develop for 1.5 hours; transfer the solution to a clean, dry spectrophotometer cell and read the absorbance at 510 nm.

6. CALCULATIONS:

Construct a calibration curve of absorbance vs. concentration (ug/L) of the compound of interest (differing response will be observed for NC, PETN, and NG). Determine concentration of compound in samples by interpolating from the calibration curve.

7. PEFERENCE:

None.

July 1990 Revision: Final

AMMONIUM PICRATE IN WATER AND WIPE SAMPLES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

AMMONIUM PICRATE IN WATER AND WIPE SAMPLES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

1. Application

This method is suitable for the determination of ammonium picrate in water and wipe samples. Ammonium picrate is converted to picric acid and quantified in that form.

2. Summary of method

Ammonium picrate is extracted from water or wipe samples with solvent. The extract is concentrated and subjected to high performance liquid chromatography (HPLC) analysis using a reverse phase column and a dual channel ultraviolet detector.

3. Interferences

Any compounds that exhibit chemical and/or physical properties similar to the compounds of interest can interfere.

4. Apparatus

- 4.1 <u>Concentrator apparatus</u>, a Kuderna-Danish (K-D) concentrator, 500-mL capacity with a 3-ball Snyder column and a 10-mL graduated receiver tube and a 500-mL flask fitted with a 1-ball Snyder column.
 - 4.2 Erlenmeyer flask, 500-mL with a ground glass stopper.
- 4.3 Evaporative concentrator, Organomation N-Evap, or equivalent.
- 4.4 <u>Liquid chromatograph</u>, Waters Associates ALC/GPC 204 liquid chromatograph equipped with a dual channel, variable wavelength detector, a model 6000A solvent-delivery system, a model 660 solvent flow programmer, model WISP 710A microprocessor and data module, or equivalents.
- 4.5 Liquid chromatographic column, a 3.9 mm i.d. by 300 mm long stainless steel column packed with 10 um particle size reverse phase material. Waters Associates u-Bonapak C_{18} column packing or equivalent.
- 4.6 <u>Separatory funnels</u>, Squibb form, 1-L capacity, or equivalent.
- 4.7 <u>Solvent clarification kit</u>, Waters Associates 85113, or equivalent.
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- 4.8 Shaker, a mechanical wrist action shaker.
- 4.9 Steam bath, a constant temperature steam bath set at 85°C.

5. Reagents

- 5.1 Acetonitrile, HPLC quality.
- 5.2 Hydrochloric acid, ACS reagent grade.
- 5.3 <u>Mobile phase solutions</u>: Prepare the ion pairing, tetrabutylammonium-phosphate solutions for the mobile phase using Waters Associates PIC Reagent A, or equivalent.
- 5.3.1 <u>Solution A</u>: Add one bottle of PIC reagent A to 1,000 mL of Milli-Q water. Stir for 5 min and then filter through a 0.45-micron filter, type HAWP for aqueous solvents.
- 5.3.2 <u>Solution B</u>: Add one bottle of PIC reagent A to 1,000 mL acetonitrile. Stir for 5 min and then filter through a 0.45-micron fiter type FHUP for organic solvents.
- 5.4 <u>Picric acid standards</u>, analytical reference grade or highest purity available. These may be obtained from chemical specialty suppliers or from military sources. Prepare standards at concentrations sufficient to cover the analytical range.
- 5.5 <u>Separatory funnels</u>, Squibb form, 1-L capacity, or equivalent.
- 5.6 <u>Solvents</u>, acetone, diethylether, methylene chloride, acetonitrile, pesticide residue quality, distilled in glass, Burdick and Jackson, or equivalent.
- 5.7 <u>Water</u>, organic-free, HPLC-grade, or water from a Millipore Milli-Q system or equivalent.

6. Procedure

- 6.1 <u>Procedure for water (rinsate) samples</u>: Samples should be collected according to the recommended practice for the collection of samples for organic analysis (Goerlitz and Brown, 1972). Mercuric chloride (40 ppm) is added as a preservative.
 - 6.1.1 Pour 500 mL water into a 1-L separatory funnel.
- 6.1.2 Add 3 mL concentrated HCl to the sample contained in the separatory funnel. Check pH to ensure acidity.

- 6.1.3 Add 75 mL methylene chloride to the sample in the separatory funnel. Stopper and shake for 1 minute. Vent the pressure often. Allow the layers to separate and draw off the methylene chloride layer into a 250-mL Erlenmeyer flask.
- 6.1.4 Repeat the extraction of the water sample two more times, using 50-mL methylene chloride volumes each time. Combine all the organic extracts in the 250-mL Erlenmeyer, which contains the first extract.
- 6.1.5 Quantitatively transfer the extract to a 500-mL K-D apparatus fitted with a 3-ball Snyder column and a 20-mL receiver. Add a micro boiling chip and 4 mL of acetonitrile.
- 6.1.6 Place the appratus on a hot-water bath (approximately 85°C). Reduce the volume of the extract to about 4 mL. Remove the K-D from the heat and allow it to cool.
- 6.1.7 Use the evaporative concentrator to reduce the volume of solvent to 0.8 to 0.9 mL by directing a stream of nitrogen onto the surface of the liquid while gently warming the receiver in a water bath.
- 6.1.8 Perform one method blank and three sample spikes at 40 ppb, 200 ppb, and 200 ppb with each batch of 20 samples.
 - 6.1.9 Proceed to HPLC analysis (6.3).
 - 6.2 Procedure for wipe samples
 - 6.2.1 Add wipe sample to 40-mL vial.
 - 6.2.2 Add 20 mL distilled water.
 - 6.2.3 Shake 15 minutes using wrist-action shaker.
 - 6.2.4 Decant water into 500+mL separatory funnel.
- 6.2.5 Repeat extraction twice, using 20 mL distilled water each time.
 - 6.2.6 Add 440 mL distilled water to separator funnel.
- 6.2.7 Perform one method blank and three sample spikes of 20 ug, 100 ug, and 100 ug with each batch.
- 6.2.8 Proceed as in 6.1.2 under "Procedure for Water (Rinsate) Samples."

- 6.3 Analysis by high pressure liquid chromatography.
- 6.3.1 The following chromatographic conditions have been found to be suitable for this analysis:

Mobile Phase: The separation is made under isocratic conditions. Combine 36 percent solution A with 64 percent solution B by using the solvent programmer.

Isocratic 36 percent acetonitrile + PIC reagent A + PICA/64 percent H₂O + PIC reagent A.

Flow Rate: 1.10 mL/min

Detector Sensitivity:

UV 254 nm 0.005 A units full scale

6.3.3 Daily calibration is performed over the following range of concentrations using picric acid as the standard material.

Standard Concentration (ng/uL)	Corresponding Ammonium Picrate in Water (ug/L)	Corresponding Ammonium Picrate in Wipe (total ug)
10	20	10
20	40	20
50	100	50
100	200	100
200	400	200
500	1000	500
1000	2000	1000

6.3.4 Add 0.1 mL of PIC reagent A to the samples, mix and make up to a volume of 1.0 mL; allow samples to stand 10 minutes and inject 10 uL into the liquid chromatographic system. Record the volume injected. Identify the peaks by retention time. Dilute any extract containing an identifiable component above the calibration range to bring it within that range.

7. Calculations

7.1 Determine sample concentration from daily calibration curve using Least Squares Fit (LSF).
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7.2 Water sample concentration is calculated as follows:

ng/uL x EV x 1 ug \pm SV = ug/L 1000 ng

where:

ng/uL = picric acid concentration in extract, from LSF.
EV = extract volume, in uL.
SV = sample volume, in Liters.

Note that picric acid concentration must be converted to ammonium picrate concentration by using the ratios of molecular weights.

7.3 Wipe sample concentration (total ug) is calculated as follows:

ng/uL x EV x 1 ug - total ug

where:

ng/uL = picric acid concentration in extract, from LSF.
EV = extract volume.

Note that picric acid concentration must be converted to ammonium picrate concentration by using the ratios of molecular weights.

References

- Goerlitz, D.F. and Law, L.M., Gas chromatographic method for the analysis of TNT and RDX explosives contaminating water and soil-core material, U.S. Geological Survey open file report 75-182.
- Goerlitz, D.F., 1978, Direct analysis of RDX and TNT in water by high-pressure liquid chromatography, U.S. Geological Survey open file report 79--.
- Goerlitz, D.F., 1978, High-performance liquid chromatography method for the analysis of picric acid in water, U.S. Geological Survey open file report.

July 1990 Revision: Final

EPA MODIFIED METHOD 5 MODIFIED METHOD 5 SAMPLING TRAIN

HETHOD 0010

MODIFIED METHOD 5 SAMPLING TRAIN

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to the determination of Destruction and Removal Efficiency (DRE) of semivolatile Principal Organic Hazardous Compounds (POHCs) from incineration systems (PHS, 1967). This method also may be used to determine particulate emission rates from stationary sources as per EPA Method 5 (see References at end of this method).

2.0 SUMMARY OF METHOD

- 2.1 Gaseous and particulate pollutants are withdrawn from an emission source at an isokinetic sampling rate and are collected in a multicomponent sampling train. Principal components of the train include a high-efficiency glass- or quartz-fiber filter and a packed bed of porous polymeric adsorbent resin. The filter is used to collect organic-laden particulate materials and the porous polymeric resin to adsorb semivolatile organic species. Semivolatile species are defined as compounds with boiling points >100°C.
- 2.2 Comprehensive chemical analyses of the collected sample are conducted to determine the concentration and identity of the organic materials.

3.0 INTERFERENCES

3.1 Oxides of nitrogen (NO_X) are possible interferents in the determination of certain water-soluble compounds such as dioxane, phenol, and urethane; reaction of these compounds with NO_X in the presence of moisture will reduce their concentration. Other possibilities that could result in positive or negative bias are (1) stability of the compounds in methylene chloride, (2) the formation of water-soluble organic salts on the resin in the presence of moisture, and (3) the solvent extraction efficiency of water-soluble compounds from aqueous media. Use of two or more ions per compound for qualitative and quantitative analysis can overcome interference at one mass. These concerns should be addressed on a compound-by-compound basis before using this method.

4.0 APPARATUS AND MATERIALS

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4.1 Sampling train:

4.1.1 A schematic of the sampling train used in this method is shown in Figure 1. This sampling train configuration is adapted from EPA Method 5 procedures, and, as such, the majority of the required equipment

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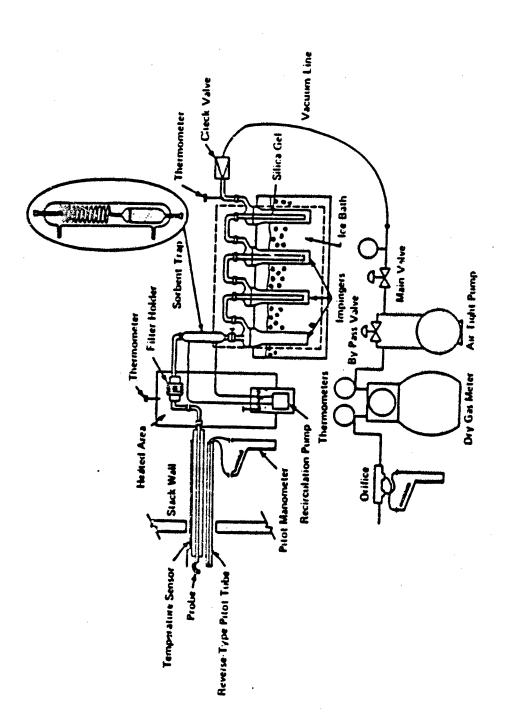


Figure 1. Modified Method 5 Sampling Train.

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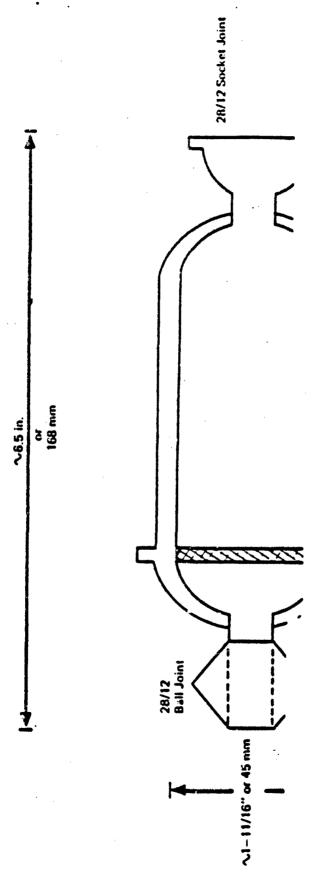
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complete organic module are not currently available, but may be assembled from commercially available laboratory glassware and a custom-fabricated sorbent trap. Details of two acceptable designs are shown in Figures 2 and 3 (the thermocouple well is shown in Figure 2).

- 4.1.3.8 Impinger train: To determine the stack-gas moisture content, four 500-mL impingers, connected in series with leak-free ground-glass joints, follow the knockout trap. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm (1/2-in.) I.D. glass tube extending about 1.3 cm (1/2 in.) from the bottom of the outer cylinder. The second impinger shall be of the Greenburg-Smith design with the standard tip. The first and second impingers shall contain known quantities of water or appropriate trapping solution. The third shall be empty or charged with a caustic solution, should the stack gas contain hydrochloric acid (HCl). The fourth shall contain a known weight of silica gel or equivalent desiccant.
- 4.1.3.9 Metering system: The necessary components are a vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (5.4°F), dry-gas meter capable of measuring volume to within 1%, and related equipment, as shown in Figure 1. At a minimum, the pump should be capable of 4 cfm free flow, and the dry-gas meter should have a recording capacity of 0-999.9 cu ft with a resolution of 0.005 cu ft. Other metering systems capable of maintaining sampling rates within 10% of isokineticity and of determining sample volumes to within 2% may be used. The metering system must be used in conjunction with a pitot tube to enable checks of isokinetic sampling rates. Sampling trains using metering systems designed for flow rates higher than those described in APTD-0581 and APTD-0576 may be used, provided that the specifications of this method are met.
- 4.1.3.10 Barometer: Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases the barometric reading may be obtained from a nearby National Weather Service station, in which case the station value (which is the absolute barometric pressure) is requested and an adjustment for elevation differences between the weather station and sampling point is applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30-m (100 ft) elevation increase (vice versa for elevation decrease).
- 4.1.3.11 Gas density determination equipment: Temperature sensor and pressure gauge (as described in Sections 2.3 and 2.4 of EPA Method 2), and gas analyzer, if necessary (as described in EPA Method 3). The temperature sensor ideally should be permanently attached to the pitot tube or sampling probe in a fixed configuration such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal.

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is identical to that used in EPA Method 5 determinations. The new components required are a condenser coil and a sorbent module, which are used to collect semivolatile organic materials that pass through the glass- or quartz-fiber filter in the gas phase.

- 4.1.2 Construction details for the basic train components are given in APTD-0581 (see Martin, 1971, in Section 13.0, References); commercial models of this equipment are also available. Specifications for the corbent module are provided in the following subsections. Additionally, the following subsections list changes to APTD-0581 and identify allowable train configuration modifications.
- 4.1.3 Basic operating and maintenance procedures for the sampling train are described in APTD-0576 (see Rom, 1972, in Section 13.0, References). As correct usage is important in obtaining valid results, all users should refer to APTD-0576 and adopt the operating and maintenance procedures outlined therein unless otherwise specified. The sampling train consists of the components detailed below.
 - 4.1.3.1 Probe nozzle: Stainless steel (316) or glass with sharp, tapered (30° angle) leading edge. The taper shall be on the outside to preserve a constant I.D. The nozzle shall be buttonhook or elbow design and constructed from seamless tubing (if made of stainless steel). Other construction materials may be considered for particular applications. A range of nozzle sizes suitable for isokinetic sampling should be available in increments of 0.16 cm (1/16 in.), e.g., 0.32-1.27 cm (1/8-1/2 in.), or larger if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedures outlined in Paragraph 9.1.
 - 4.1.3.2 Probe liner: Borosilicate or quartz-glass tubing with a heating system capable of maintaining a gas temperature of 120 ± 14°C (248 ± 25°F) at the exit end during sampling. (The tester may opt to operate the equipment at a temperature lower than that specified.) Because the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-C581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) are considered acceptable. Either borosilicate or quartz-glass probe liners may be used for stack temperatures up to about 480°C (900°F). Quartz liners shall be used for temperatures between 480 and 900°C (900 and 1650°F). (The softeming temperature for borosilicate is 820°C (1508°F), and for quartz 1500°C (2732°F).) Water-cooling of the stainless steel sheath will be necessary at temperatures approaching and exceeding 500°C.
 - 4.1.3.3 Pitot tube: Type S, as described in Section 2.1 of EPA Method 2, or other appropriate devices (Vollaro, 1976). The pitot tube shall be attached to the probe to allow constant monitoring of the stack-gas velocity. The impact (high-pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see EPA Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of EPA Method 2.

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- 4.1.3.4 <u>Differential pressure gauge</u>: Inclined manometer of equivalent device as described in Section 2.2 of EPA Method 2. One manometer shall be used for velocity—head (ΔP) readings and the other for orifice differential pressure (ΔH) readings.
- 4.1.3.5 Filter holder: Borosilicate glass, with a glass frit filter support and a sealing gasket. The sealing gasket should be made of materials that will not introduce organic material into the gas stream at the temperature at which the filter holder will be maintained. The gasket shall be constructed of Teflon or materials of equal or better characteristics. The holder design shall provide a positive seal against leakage at any point along the filter circumference. The holder shall be attached immediately to the outlet of the cyclone or cyclone bypass.
- 4.1.3.6 Filter heating system: Any heating system capable of maintaining a temperature of $120 \pm 14^{\circ}\text{C}$ (248 \pm 25°F) around the filter holder during sampling. Other temperatures may be appropriate for particular applications. Alternatively, the tester may opt to operate the equipment at temperatures other than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.
- This unit consists of three 4.1.3.7 Organic sampling module: sections, including a gas-conditioning section, a sorbent trap, and a condensate knockout trap. The gas-conditioning system shall be capable of conditioning the gas leaving the back half of the filter holder to a temperature not exceeding 20°C (68°F). The sorbent trap shall be sized to contain approximately 20 g of porous polymeric resin (Rohm and Haas XAD-2 or equivalent) and shall be jacketed to maintain the internal gas temperature at 17 \pm 3°C (62.5 \pm 5.4°F). The most commonly used coolant is ice water from the impinger ice-water bath, constantly circulated through the outer jacket, using rubbur or plastic tubing and a peristaltic pump. The sorbent trap should be outfitted with a glass well or depression, appropriately sized to accommodate a small thermocouple in the trap for monitoring the gas entry temperature. The condensate knockout trap shall be of sufficient size to collect the condensate following gas conditioning. The organic module components shall be oriented to direct the flow of condensate formed vertically downward from the conditioning section, through the adsorbent media, and into the condensate knockout trap. The knockout trap is usually similar in appearance to an empty impinger directly underneath the sorbent module: it may be oversized but should have a shortened center stem (at a minimum, one-half the length of the normal impinger stems) to collect a large volume of condensate without bubbling and overflowing into the impinger train. All surfaces of the organic module wetted by the gas sample shall be fabricated of borosilicate glass, Teflon, or other inert materials. Commercial versions of the

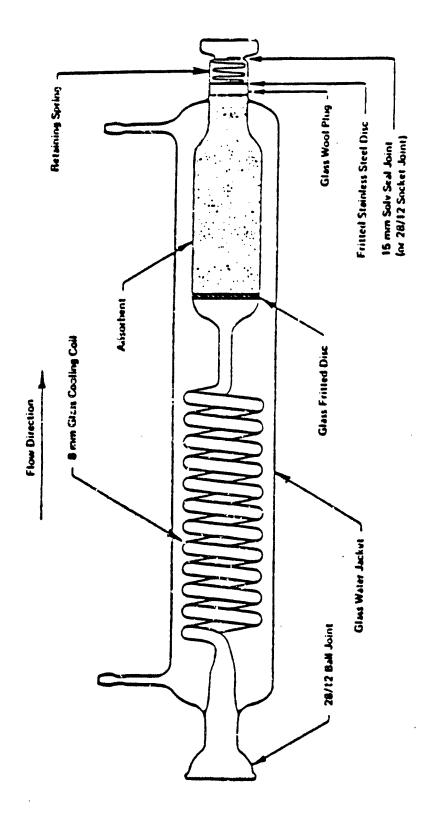


Figure 3. Adsorbent Sampling System.

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Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see EPF Method 2, Figure 2-7). As a second alternative, if a difference of no more than 1% in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube.

4.1.3.12 Calibration/field-preparation record: A permanently bound laboratory notebook, in which duplicate copies of data may be made as they are being recorded, is required for documenting and recording calibrations and preparation procedures (i.e., filter and silica gel tare weights, clean XAD-2, quality assurance/quality control check results, dry-gas meter, and thermocouple calibrations, etc.). The duplicate copies should be detachable and should be stored separately in the test program archives.

4.2 Sample Recovery:

- 4.2.1 Probe liner: Probe nozzle and organic module conditioning section brushes; nylon bristle brushes with stainless steel wire handles are required. The probe brush shall have extensions of stainless steel, Teflon, or inert material at least as long as the probe. The brushes shall be properly sized and shaped to brush out the probe liner, the probe nozzle, and the organic modula conditioning section.
- 4.2.2 Wash bottles: Three. Teflon or glass wash bottles are recommended; polyethylene wash bottles should not be used because organic contaminants may be extracted by exposure to organic solvents used for sample recovery.
- 4.2.3 Glass sample storage containers: Chemically resistant, borosilicate amber and clear glass bottles, 500-mL or 1,000-mL. Bottles should be tinted to prevent action of light on sample. Screw-cap liners shall be either Teflon or constructed so as to be leak-free and resistant to chemical attack by organic recovery solvents. Narrow-mouth glass bottles have been found to exhibit less tendency toward leakage.
- 4.2.4 Petri dishes: Glass, sealed around the circumference with wide (1-in.) Teflon tape, for storage and transport of filter samples.
- 4.2.5 Graduated cylinder and/or balances: To measure condensed water to the nearest 1 mL or 1 g. Graduated cylinders shall have subdivisions not ≥ 2 mL. Laboratory triple-beam balances capable of weighing to ± 0.5 g or better are required.
- 4.2.6 Plastic storage containers: Screw-cap polypropylene or polyethylene containers to store silica gel.
- 4.2.7 Funnel and rubber policeman: To aid in transfer of silica gel to container (not necessary if silica gel is weighed in field).

- 4.2.8 Funnels: Glass, to aid in sample recovery.
- 4.3 Filters: Glass- or quartz-fiber filters, without organic binder, exhibiting at least 99.95% efficiency (<0.05% penetration) on 0.3-um dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71. Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO₂ or SO₃, the filter material must be of a type that is unreactive to SO₂ or SO₃. Reeve Angel 934 AH or Schleicher and Schwell #3 filters work well under these conditions.
- 4.4 <u>Crushed ice</u>: Quantities ranging from 10-50 lb may be necessary during a sampling run, depending on ambient air temperature.
- 4.5 Stopcock grease: Solvent-insoluble, heat-stable silicone grease. Use of silicone grease upstream of the module is not permitted, and amounts used on components located downstream of the organic module shall be minimized. Silicone grease usage is not necessary if screw-on connectors and Teflon sleeves or ground-glass joints are used.
- 4.6 Glass wool: Used to plug the unfritted end of the sorbent module. The glass-wool fiber should be solvent-extracted with methylene chloride in a Soxhlet extractor for 12 hr and air-dried prior to use.

5.0 REAGENTS

- 5.1 Adsorbent resin: Porous polymeric resin (XAD-2 or equivalent) is recommended. These resins shall be cleaned prior to their use for sample collection. Appendix A of this method should be consulted to determine appropriate precleaning procedure. For best results, resin used should not exhibit a blank of higher than 4 mg/kg of total chromatographable organics (TCO) (see Appendix B) prior to use. Once cleaned, resin should be stored in an airtight, wide-mouth amber glass container with a Teflon-lined cap or placed in one of the glass sorbent modules tightly sealed with Teflon film and elastic bands. The resin should be used within 4 wk of the preparation.
- 5.2 Silica gel: Indicating type, 6-16 mesh. If previously used, dry at 175°C (350°F) for 2 hr before using. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.
- 5.3 Impinger solutions: Distilled organic-free water (Type II) shall be used, unless sampling is intended to quantify a particular inorganic gaseous species. If sampling is intended to quantify the concentration of additional species, the impinger solution of choice shall be subject to Administrator approval. This water should be prescreened for any compounds of interest. One hundred mL will be added to the specified impinger; the third impinger in the train may be charged with a basic solution (1 N sodium hydroxide or sodium acetate) to protect the sampling pump from acidic gases. Sodium acetate should be used when large sample volumes are anticipated because sodium hydroxide will react with carbon dioxide in aqueous media to form sodium carbonate, which may possibly plug the impinger.

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5.4 Sample recovery reagents:

- 5.4.1 Methylene chloride: Distilled-in-glass grade is required for sample recovery and cleanup (see Note to 5.4.2 below).
- 5.4.2 Methyl alcohol: Distilled-in-glass grade is required for sample recovery and cleanup.

 NOTE: Organic solvents from metal containers may have a high residue blank and should not be used. Sometimes suppliers transfer solvents from metal to glass bottles; thus blanks shall be run prior to field use and only solvents with low blank value (<0.001%) shall be used.
- 5.4.3 Water: Water (Type II) shall be used for rinsing the organic module and condenser component.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 Because of complexity of this method, field personnel should be trained in and experienced with the test procedures in order to obtain reliable results.

6.2 Laboratory preparation:

- 6.2.1 All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified.
- 6.2.2 Weigh several 200- to 300-g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus containers. As an alternative to preweighing the silica gel, it may instead be weighed directly in the impinger or sampling holder just prior to train assembly.
- 6.2.3 Check filters visually against light for irregularities and flaws or pinhole leaks. Label the shipping containers (glass Petri dishes) and keep the filters in these containers at all times except during sampling and weighing.
- 6.2.4 Desiccate the filters at $20 + 5.6^{\circ}\text{C}$ (68 \pm 10°F) and ambient pressure for at least 24 hr, and weigh at intervals of at least 6 hr to a constant weight (i.e., <0.5-mg change from previous weighing), recording results to the nearest 0.1 mg. During each weighing the filter must not be exposed for more than a 2-min period to the laboratory atmosphere and relative humidity above 50%. Alternatively (unless otherwise specified by the Administrator), the filters may be oven-dried at 105°C (220°F) for 2-3 hr, desiccated for 2 hr, and weighed.

6.3 Preliminary field determinations:

- 6.3.1 Select the sampling site and the minimum number of sampling points according to EPA Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and range of velocity heads using EPA Method 2. It is recommended that a leak-check of the pitot lines (see EPA Method 2, Section 3.1) be performed. Determine the stack-gas moisture content using EPA Approximation Method 4 or its alternatives to establish estimates of isokinetic sampling-rate settings. Determine the stack-gas dry molecular weight, as described in EPA Method 2, Section 3.6. If integrated EPA Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the sample run.
- 6.3.2 Select a nozzle size based on the range of velocity heads so that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of EPA Method 2).
- 6.3.3 Select a suitable probe liner and probe length so that all traverse points can be sampled. For large stacks, to reduce the length of the probe, consider sampling from opposite sides of the stack.
- 6.3.4 A minimum of 3 dscm (105.9 dscf) of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of POHCs from incineration systems. Additional sample volume shall be collected as necessitated by analytical detection limit constraints. To determine the minimum sample volume required, refer to sample calculations in Section 10.0.
- 6.3.5 Determine the total length of sampling time needed to obtain the identified minimum volume by comparing the anticipated average sampling rate with the volume requirement. Allocate the same time to all traverse points defined by EPA Method 1. To avoid timekeeping errors, the length of time sampled at each traverse point should be an integer or an integer plus one-half min.
- 6.3.6 In some circumstances (e.g., batch cycles) it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas-sample volumes. In these cases, the Administrator's approval must first be obtained.

6.4 Preparation of collection train:

6.4.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered with Teflon film or aluminum foil until just prior to assembly or until sampling is about to begin.

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- 6.4.2 Fill the sorbent trap section of the organic module with approximately 20 g of clean adsorbent resin. While filling, ensure that the trap packs uniformly, to eliminate the possibility of channeling. When freshly cleaned, many adsorbent resins carry a static charge, which will cause clinging to trap walls. This may be minimized by filling the trap in the presence of an antistatic device. Commercial antistatic devices include Model-204 and Model-210 manufactured by the 3M Company, St. Paul, Minnesota.
- 6.4.3 If an impinger train is used to collect moisture, place 100 mL of water in each of the first two impingers, leave the third impinger empty (or charge with caustic solution, as necessary), and transfer approximately 200-300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.
- 6.4.4 Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.
- 6.4.5 When glass liners are used, install the selected nozzle using a Viton-A O-ring when stack temperatures are \(260^{\circ}C \) (500^{\circ}F) and a woven glass-fiber gasket when temperatures are higher. See APTD-0576 (Rom, 1972) for details. Other connecting systems utilizing either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above, or by a leak-free direct mechanical connection. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.
- 6.4.6 Set up the train as in Figure 1. During assembly, do not use any silicone grease on ground-glass joints that are located upstream of the organic module. A very light coating of silicone grease may be used on all ground-glass joints that are located downstream of the organic module, but it should be limited to the outer portion (see APTD-0576) of the ground-glass joints to minimize silicone-grease contamination. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and the filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack. The organic module condenser must be maintained at a temperature of 17 ± 3°C. Connect all temperature sensors to an appropriate potentiometer/display unit. Check all temperature sensors at ambient temperature.
- 6.4.7 Place crushed ice around the impingers and the organic module condensate knockout.

- 6.4.8 Turn on the sorbent module and condenser coil coolant recirculating pump and begin monitoring the scrbent module gas entry temperature. Ensure proper sorbent module gas entry temperature before proceeding and again before any sampling is initiated. It is extremely important that the XAD-2 resin temperature never exceed 50°C (122°F), because thermal decomposition will occur. During testing, the XAD-2 temperature must not exceed 20°C (68°F) for efficient capture of the semivolatile species of interest.
- 6.4.9 Turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize.

6.5 Leak-check procedures

6.5.1 Pre-test leak-check:

- 6.5.1.1 Because the number of additional intercomponent connections in the Semi-VOST train (over the M5 Train) increases the possibility of leakage, a pre-test leak-check is required.
- 6.5.1.2 After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 381-mm Hg (15-in. Hg) vacuum.

 (NOTE: A lower vacuum may be used, provided that it is not exceeded

NOTE: A lower vacuum may be used, provided that it is not exceeded during the test.)

- 6.5.1.3 If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first attaching a carbon-filled leak-check impinger (shown in Figure 4) to the inlet of the filter holder (cyclone, if applicable) and then plugging the inlet and pulling a 381-mm Hg (15-in. Hg) vacuum. (Again, a lower vacuum may be sed, provided that it is not exceeded during the test.) Then, connect the probe to the train and leak-check at about 25-mm Hg (1-in. Hg) vacuum; alternatively, leak-check the probe with the rest of the sampling train in one step at 381-mm Hg (15-in. Hg) vacuum. Leakage rates in excess of 4% of the average sampling rate or >0.00057 m³/min (0.02 cfm), whichever is less, are unacceptable.
- 6.5.1.4 The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with fine-adjust valve fully open and coarse-adjust valve completely closed. Partially open the coarse-adjust valve and slowly close the fine-adjust valve until the desired vacuum is reached. Do not reverse direction of the fine-adjust valva; this will cause water to back up into the organic module. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check, as shown below, and start over.

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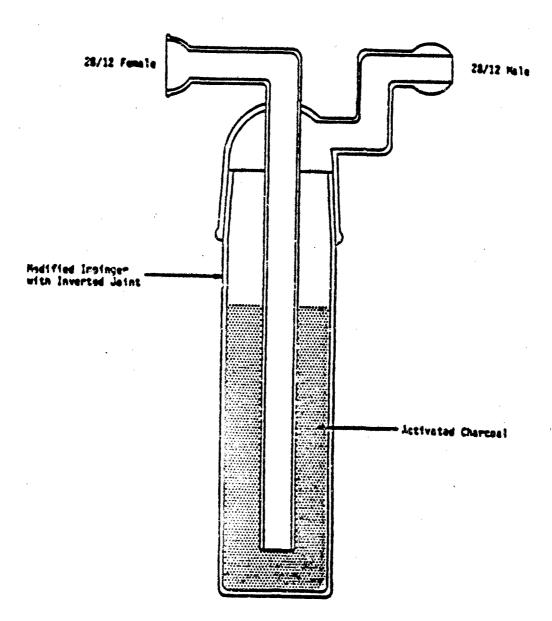


Figure 4. Leak-check impinger.

6.5.1.5 When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable). When the vacuum drops to 127 mm (5 in.) Hg or less, immediately close the coarse-adjust valve. Switch off the pumping system and reopen the fine-adjust valve. Do not reopen the fine-adjust valve until the coarse-adjust valve has been closed. This prevents the water in the impingers from being forced backward into the organic module and silica gel from being entrained backward into the third impinger.

6.5.2 Leak-checks during sampling run:

- 6.5.2.1 If, during the sampling run, a component (e.g., fliter assembly, impinger, or sorbent trap) change becomes necessary, a leak-check shall be conducted immediately after the interruption of sampling and before the change is made. The leak-check shall be done according to the procedure outlined in Paragraph 6.5.1, except that it shall be done at a vacuum greater than or equal to the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered. If a higher leakage rate is obtained, the tester shall void the sampling run. (It should be noted that any "correction" of the sample volume by calculation by calculation reduces the integrity of the pollutant concentrations data generated and must be avoided.)
- 6.5.2.2 Immediately after a component change, and before sampling is reinitiated, a leak-check similar to a pre-test leak-check must also be conducted.

6.5.3 Post-test leak-check:

6.5.3.1 A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done with the same procedures as those with the pre-test leak-check, except that it shall be conducted at a vacuum greater than or equal to the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate, correct the sample volume (as shown in the calculation section of this method), and consider the data obtained of questionable reliability, or void the sampling run.

. 5.5 Sampling-train operation:

6.6.1 During the sampling run, maintain an isokinetic sampling rate to within 10% of true isokinetic, unless otherwise specified by the Administrator. Maintain a temperature around the filter of $120 \pm 14^{\circ}\text{C}$ (248 + 25°F) and a gas temperature entering the sorbent trap at a maximum of 20°C (68°F).

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- 8.6.2 For each run, record the data required on a data sheet such as the one shown in Figure 5. Be sure to record the initial dry-gameter reading. Record the dry-gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5 at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity-head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.
- 6.6.3 Clean the stack access ports prior to the test run to eliminate the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are at the specified temperature, and verify that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point, with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations, are available. These nomographs are designed for use when the Type S pitot-tube coefficient is 0.84 + 0.02 and the stack-gas equivalent density (dry molecular weight) is equal to 29 + 4. APTD-0576 details the procedure for using the nomographs. If the stack-gas molecular weight and the pitot-tube coefficient are outside the above ranges, do not use the nomographs unless appropriate steps (Shigehara, 1974) are taken to compensate for the deviations.
- 6.6.4 When the stack is under significant negative pressure (equivalent to the height of the impinger stem), take care to close the coarse-adjust valve before inserting the probe into the stack, to prevent water from backing into the organic module. If necessary, the pump may be turned on with the coarse-adjust valve closed.
- 6.6.5 When the probe is in position, block off the openings around the probe and stack access port to prevent unrepresentative dilution of the gas stream.
- 6.6.6 Traverse the stack cross section, as required by EPA Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the access port, in order to minimize the chance of extracting deposited material.
- 6.6.7 During the test run, make periodic adjustments to keep the temperature around the filter holder and the organic module at the proper levels; add more ice and, if necessary, salt to maintain a temperature of <20°C (68°F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

Average Calibrated Hozzle Diameter; cm (in) Statle Pressure, mm Hu (in. Hq) Horrie Identification He. lest flate, m3/min, (cfa) Probe Heater Setting Probe Liner Haterial Probe Length, m (ft) Authort Temperature Aurometric Pressure Assumed Noisture S filler Be. Schematic of Stack Cross Section Pilot Tube Caefficient Cp _ Sample Ben Re. Noter Box No. Neter 16 C factor Operator _ Am Re. Lecet ien Pate | Plant

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Figure 5. Particulate field data.

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- 6.6.8 If the pressure drop across the filter or sorbent trap becomes too high, making isokinetic sampling difficult to maintain, the filter/sorbent trap may be replaced in the midst of a sample run. Using another complete filter holder/sorbent trap assembly is recommended, rather than attempting to change the filter and resin themselves. After a new filter/sorbent trap assembly is installed, conduct a leak-check. The total particulate weight shall include the summation of all filter assembly catches.
- 6.6.9 A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.
- 6.6.10 Note that when two or more trains are used, separate analysis of the front-half (if applicable) organic-module and impinger (if applicable) catches from each train shall be performed, unless identical nozzle sizes were used on all trains. In that case, the front-half catches from the individual trains may be combined (as may the impinger catches), and one analysis of front-half catch and one analysis of impinger catch may be performed.
- 6.6.11 At the end of the sample run, turn off the coarse-adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry-gas meter reading, and conduct a post-test leak-check. Also, leak-check the pitot lines as described in EPA Method 2. The lines must pass this leak-check in order to validate the velocity-head data.
- 6.5.12 Calculate percent isokineticity (see Section 10.8) to determine whether the run was valid or another test run should be made.

7.0 SAMPLE RECOVERY

7.1 Preparation:

- 7.1.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over the tip to prevent losing or gaining particulate matter. Do not cap the probe tip tightly while the sampling train is cooling down because this will create a vacuum in the filter holder, drawing water from the impingers into the sorbent module.
- 7.1.2 Before moving the sample train to the cleanup site, remove the probe from the sample train and cap the open outlet, being careful not to lose any condensate that might be present. Cap the filter inlet.

Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the organic module and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the organic module.

- 7.1.3 Cap the filter-holder outlet and the inlet to the organic module. Separate the sorbent trap section of the organic module from the condensate knockout trap and the gas-conditioning section. Cap all organic module openings. Disconnect the organic-module knockout trap from the impinger train inlet and cap both of these openings. Ground-glass stoppers, Teflon caps, or caps of other inert materials may be used to seal all openings.
- 7.1.4 Transfer the probe, the filter, the organic-module components, and the impinger/condenser assembly to the cleanup area. This area should be clean and protected from the weather to minimize sample contamination or loss.
- 7.1.5 Save a portion of all washing solutions (methanol/methylene chloride, Type II water) used for cleanup as a blank. Transfer 200 mL of each solution directly from the wash bottle being used and place each in a separate, prelabeled glass sample container.
- 7.1.6 Inspect the train prior to and during disassembly and note any abnormal conditions.

7.2 Sample containers:

- 7.2.1 Container no. 1: Carefully remove the filter from the filter holder and place it in its identified Petri dish container. Use a pair or pairs of tweezers to handle the filter. If it is necessary to fold the filter, ensure that the particulate cake is inside the fold. Carefully transfer to the Petri dish any particulate matter or filter fibers that adhere to the filter-holder gasket, using a dry nylon bristle brush or sharp-edged blade, or both. Label the container and seal with 1-in.-wide Teflon tape around the circumference of the lid.
- 7.2.2 Container no. 2: Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components first with methanol/methylene chloride (1:1 v/v) into a glass container. Distilled water may also be used. Retain a water and solvent blank and analyze in the same manner as with the samples. Perform rinses as follows:
 - 7.2.2.1 Carefully remove the probe nozzle and clean the incide surface by rinsing with the solvent mixture (1:1 v/v methanol/methylene chloride) from a wash bottle and brushing with a nylon bristle brush. Brush until the rinse shows no visible particles; then make a final rinse of the inside surface with the solvent mix. Brush and rinse the inside parts of the Swagelok fitting with the solvent mix in a similar way until no visible particles remain.

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- 7.2.2.2 Have two people rinse the probe liner with the solven mix by tilting and rotating the probe while squirting solvent int its upper end so that all inside surfaces will be wetted wit solvent. Let the solvent drain from the lower end into the sample container. A glass funnel may be used to aid in transferring liquiwashes to the container.
- 7.2.2.3 Follow the solvent rinse with a probe brush. Hold the probe in an inclined position and squirt solvent into the upper encewhile pushing the probe brush through the probe with a twisting action; place a sample container underneath the lower end of the probe and catch any solvent and particulate matter that is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the solvent or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above-prescribed manner at least six times (metal probes have small crevices in which particulate matter can be entrapped). Rinse the brush with solvent and quantitatively collect these washings in the sample container. After the brushing, make a final solvent rinse of the probe as described above.
- 7.2.2.4 It is recommended that two people work together to clean the probe to minimize sample losses. Eetween sampling runs, keep brushes clean and protected from contamination.
- 7.2.2.5 Clean the inside of the front half of the filter holder and cyclone/cyclone flask, if used, by rubbing the surfaces with a hylon bristle brush and rinsing with methanol/methylene chloride (1:1 v/v) mixture. Rinse each surface three times or more if needed to remove visible particulate. Hake a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone and cyclone flask (if applicable). Brush and rinse any particulate material adhering to the inner surfaces of these components into the front-half rinse sample. After all solvent washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that solvent will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to identify its contents.
- 7.2.3 Container no. 3: The sorbent trap section of the organic module may be used as a sample transport container, or the spent resin may be transferred to a separate glass bottle for shipment. If the sorbent trap itself is used as the transport container, both ends should be sealed with tightly fitting caps or plugs. Ground-glass stoppers or Teflon caps may be used. The sorbent trap should then be labeled, covered with aluminum foil, and packaged on ice for transport to the laboratory. If a separate bottle is used, the spent resin should be quantitatively transferred from the trap into the clean bottle. Resin that adheres to the walls of the trap should be recovered using a rubber policeman or spatula and added to this bottle.

- 7.2.4 Container no. 4: Measure the volume of condensate collected in the condensate knockout section of the organic module to within +1 mL by using a graduated cylinder or by weighing to within +0.5 g using a triple-beam balance. Record the volume or weight of liquid present and note any discoloration or film in the liquid catch. Transfer this liquid to a prelabeled glass sample container. Inspect the back half of the filter housing and the gas-conditioning section of the organic module. If condensate is observed, transfer it to a graduated or weighing bottle and measure the volume, as described above. Add this material to the condensate knockout-trap catch.
- 7.2.5 Container no. 5: All sampling train components located between the high-efficiency glass- or quartz-fiber filter and the first wet impinger or the final condenser system (including the heated Teflon line connecting the filter outlet to the condenser) should be thoroughly rinsed with methanol/methylene chloride (1:1 v/v) and the rinsings combined. This rinse shall be separated from the condensate. If the spent resin is transferred from the sorbent trap to a separate sample container for transport, the sorbent trap shall be thoroughly rinsed until all sample-wetted surfaces appear clean. Visible films should be removed by brushing. Whenever train components are brushed, the brush should be subsequently rinsed with solvent mixture and the rinsings added to this container.
- 7.2.6 Container no. 6: Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere strongly to the impinger wall. Because the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, weigh the container and its contents to 0.5 g or better.

7.3 Impinger water:

- 7.3.1 Make a notation of any color or film in the liquid catch. Measure the liquid in the first three impingers to within +1 mL by using a graduated cylinder or by weighing it to within +0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.
- 7.3.2 Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Paragraph 4.1.3.7). Amber glass containers should be used for storage of impinger catch, if required.
- 7.3.3 If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

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7.4 Sample preparation for shipment: Prior to shipment, recheck all sample containers to ensure that the caps are well secured. Seal the lids of all containers around the circumference with Teflon tape. Ship all liquing samples upright on ice and all particulate filters with the particulate cate facing upward. The particulate filters should be shipped unrefrigerated.

8.0 ANALYSIS

3.1 Sample preparation:

- 8.1.1 General: The preparation steps for all samples will result in a finite volume of concentrated solvent. The final sample volum (usually in the 1- to 10-mL range) is then subjected to analysis b GC/MS. All samples should be inspected and the appearance documented All samples are to be spiked with surrogate standards as received from the field prior to any sample manipulations. The spike should be at level equivalent to 10 times the MOL when the solvent is reduced in volume to the desired level (i.e., 10 mL). The spiking compounds should be the stable isotopically labeled analog of the compounds of interest of a compound that would exhibit properties similar to the compounds of interest, be easily chromatographed, and not interfere with the analysis of the compounds of interest. Suggested surrogate spiking compounds are: deuterated naphthalene, chrysene, phenol, nitrobenzene, chlorobenzene, toluene, and carbon-13-labeled pentachlorophenol.
- 8.1.2 Condensate: The "condensate" is the moisture collected in the first impinger following the XAD-2 module. Spike the condensate with the surrogate standards. The volume is measured and recorded and then transferred to a separatory funnel. The pH is to be adjusted to pH 2 with 6 N sulfuric acid, if necessary. The sample container and graduated cylinder are sequentially rinsed with three successive 10-mL aliquots of the extraction solvent and added to the separatory funnel. The ratio of solvent to aqueous sample should be maintained at 1:3. Extract the sample by vigorously shaking the separatory funnel for 5 min. After complete separation of the phases, remove the solvent and transfer to a Kuderna-Danish concentrator (K-D), filtering through a bed of precleaned, dry sodium sulfate. Repeat the extraction step two additional times. Adjust the pH to 11 with 6 N sodium hydroxide and reextract combining the acid and base extracts. Rinse the sodium sulfate into the K-D with fresh solvent and discard the desiccant. Add Teflon boiling chips and concentrate to 10 mL by reducing the volume to slightly less than 10 mL and then bringing to volume with fresh solvent. In order to achieve the necessary detection limit, the sample volume can be further reduced to 1 mL by using a micro column K-D or nitrogen blow-down. Should the sample start to exhibit precipitation, the concentration step should be stopped and the sample redissolved with fresh solvent taking the volume to some finite amount. After adding a standard (for the purpose of quantitation by GC/MS), the sample is ready for analysis, as discussed in Paragraph 8.2.

- 8.1.3 Impinger: Spike the sample with the surrogate standards; measure and record the volume and transfer to a separatory funnel. Proceed as described in Paragraph 8.1.2.
- Spike the resin directly with the surrogate XAD-2: standards. Transfer the resin to the all-glass thimbles by the following procedure (care should be taken so as not to contaminate the thimble by touching it with anything other than tweezers or other solvent-rinsed mechanical holding devices). Suspend the XAD-2 module directly over the thimble. The glass frit of the module (see Figure 2) should be in the upposition. The thimble is contained in a clean beaker, which will serve Using a Teflon squeeze bottle, flush the to catch the solvent rinses. XAD-2 into the thimble. Thoroughly rinse the glass module with solvent into the beaker containing the thimble. Add the XAD-2 glass-wool plug to the thimble. Cover the XAD-2 in the thimble with a precleaned glass-wool plug sufficient to prevent the resin from floating into the solvent reservoir of the extractor. If the resin is wet, effective extraction can be accomplished by loosely packing the resin in the thimble. If a question arises concerning the completeness of the extraction, a second extraction, without a spike, is advised. The thimble is placed in the extractor and the rinse solvent contained in the beaker is added to the solvent reservoir. Additional solvent is added to make the reservoir approximately two-thirds full. Add Teflon boiling chips and assemble the apparatus. Adjust the heat source to cause the extractor to cycle 5-6 times per hr. Extract the resin for 16 hr. Transfer the solvent and three 10-mL rinses of the reservoir to a K-D and concentrate as described in Paragraph 8.1.2.
- 8.1.5 Particulate filter (and cyclone catch): If particulate loading is to be determined, weigh the filter (and cyclone catch, if applicable). The particulate filter (and cyclone catch, if applicable) is transferred to the glass thimble and extracted simultaneously with the XAD-2 resin.
- 8.1.6 Train solvent rinses: All train rinses (i.e., probe, impinger, filter housing) using the extraction solvent and methanol are returned to the laboratory as a single sample. If the rinses are contained in more than one container, the intended spike is divided equally among the containers proportioned from a single syringe volume. Transfer the rinse to a separatory funnel and add a sufficient amount of organic-free water so that the methylene chloride becomes immiscible and its volume no longer increases with the addition of more water. The extraction and concentration steps are then performed as described in Paragraph 8.1.2.

8.2 Sample analysis:

8.2.1 The primary analytical tool for the measurement of emissions from hazardous waste incinerators is GC/MS using fused-silica capillary GC columns, as described in Method 8270 in Chapter Four of this manual. Because of the nature of GC/MS instrumentation and the cost associated

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with sample analysis, prescreening of the sample extracts by chromatography/flame ionization detection (GC/FID) or with electicapture (GC/ECD) is encouraged. Information regarding the complexity concentration level of a sample prior to GC/MS analysis can be enormous help. This information can be obtained by using eith capillary columns or less expensive packed columns. However, the faceen should be performed with a column similar to that used with the GC/MS. Keep in mind that GC/FID has a slightly lower detection lint than GC/MS and, therefore, that the concentration of the sample can adjusted either up or down prior to analysis by GC/MS.

- 8.2.2 The mass spectrometer will be operated in a full scan (4 450) mode for most of the analyses. The range for which data a acquired in a GC/MS run will be sufficiently broad to encompass the majions, as listed in Chapter Four, Method 8270, for each of the designat POHCs in an incinerator effluent analysis.
- 8.2.3 For most purposes, electron ionization (EI) spectra will collected because a majority of the POHCs give reasonable EI spectr Also, EI spectra are compatible with the NBS Library of Mass Spectra a other mass spectral references, which aid in the identification proce for other components in the incinerator process streams.
- 8.2.4 To clarify some identifications, chemical ionization (C spectra using either positive ions or negative ions will be used elucidate molecular-weight information and simplify the fragmentatic patterns of some compounds. In no case, however, should CI spectra alor be used for compound identification. Refer to Chapter Four, Method 8270 for complete descriptions of GC conditions, MS conditions, ar quantitative and quantitative identification.

9.0 CALIBRATION

- 9.1 Probe nozzle: Probe nozzles shall be calibrated before thei initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make measurements at three separate places across the diameter and obtain the average of the measurements. The difference between the high and low numbers shall no exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded they shall be reshaped, sharpened, and recalibrated before use. Each nozzleshall be permanently and uniquely identified.
- 9.2 Pitot tube: The Type S pitot tube assembly shall be calibrate according to the procedure putlined in Section 4 of EPA Method 2, or assigned a nominal coefficient of 0.84 if it is not visibly nicked, dented, or corroder and if it meets design and intercomponent spacing specifications.

9.3 Metering system:

- 9.3.1 Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry-gas meter dial readings to correspond to the wet-test meter readings, calibration factors may be used to correct the gas meter dial readings mathematically to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: Make a 10-min calibration run at 0.00057 m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet-test and dry-gas meter volumes and divide the difference by 10 to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).
- 9.3.2 After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). The vacuum shall be set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet-test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5%, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.
- 9.3.3 Leak-check of metering system: That portion of the sampling train from the pump to the orifice meter (see Figure 1) should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 6): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13-18 cm (5-7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for 1 min. A loss of pressure on the manometer indicates a leak in the meter box. Leaks, if present, must be corrected.

NOTE: If the dry-gas-meter coefficient values obtained before and after a test series differ by >5%, either the test series shall be voided or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

9.4 <u>Probe heater</u>: The probe-heating system shall be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

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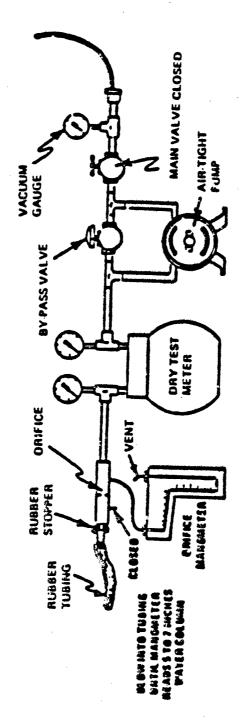


Figure 6. Leak-check of meter box.

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- 9.5 Temperature gauges: Each thermocouple must be permanently and uniquely marked on the casting; all mercury-in-glass reference thermometers must conform to ASTM E-1 63C or 63F specifications. Thermocouples should be calibrated in the laboratory with and without the use of extension leads. If extension leads are used in the field, the thermocouple readings at ambient air temperatures, with and without the extension lead, must be noted and recorded. Correction is necessary if the use of an extension lead produces a change >1.5%.
 - 9.5.1 Impinger, organic module, and dry-gas meter thermocouples: For the thermocouples used to measure the temperature of the gas leaving the impinger train and the XAD-2 resin bed, three-point calibration at ice-water, room-air, and boiling-water temperatures is necessary. Accept the thermocouples only if the readings at all three temperatures agree to +2°C (3.6°F) with those of the absolute value of the reference thermometer.
 - 9.5.2 Probe and stack thermocouple: For the thermocouples used to indicate the probe and stack temperatures, a three-point calibration at ice-water, boiling-water, and hot-oil-bath temperatures must be performed; it is recommended that room-air temperature be added, and that the thermometer and the thermocouple agree to within 1.5% at each of the calibration points. A calibration curve (equation) may be constructed (calculated) and the data extrapolated to cover the entire temperature range suggested by the manufacturer.
- 9.6 Barometer: Adjust the barometer initially and before each test series to agree to within ± 25 mm Hg (0.1 in. Hg) of the mercury barometer or the corrected barometric pressure value reported by a nearby National Weather Service Station (same altitude above sea level).
- 9.7 <u>Triple-beam balance</u>: Calibrate the triple-beam balance before each test series, using Class-S standard weights; the weights must be within +0.5% of the standards, or the balance must be adjusted to meet these limits.

10.0 CALCULATIONS

10.1 Carry out calculations. Round off figures after the final calculation to the correct number of significant figures.

10.2 Nomenclature:

 A_n = Cross-sectional area of nozzle, m^2 (ft²).

 $a_{\rm WS}$ = Water vapor in the gas stream, proportion by volume.

Cd : Type S pitot tube coefficient (nominally 0.84 ± 0.02), dimensionless.

I = Percent of isokinetic sampling.

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- La = Maximum acceptable leakage rate for a leak-check, either pre-tes or following a component change; equal to 0.00057 m³/min (0.0 cfm) or 4% of the average sampling rate, whichever is less.
- L_i = Individual leakage rate observed during the leak-check conducted prior to the "i^{vii}" component change (i = 1, 2, 3...n) m³/min (cfm).
- L_p = Leakage rate observed during the post-test leak-check, m^3/min (cfm).
- M_d = Stack-gas dry molecular weight, g/g-mole (1b/1b-mole).
- $M_{\rm w}$ = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
- Pbar = Barometric pressure at the sampling site, mm Hg (in. Hg).
 - Ps = Absolute stack-gas pressure, mm Hg (in. Hg).
- P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
 - R = Ideal gas constant, 0.06236 mm Hg-m 3 /K-g-mole (21.85 in. Hg-ft 3 / $^{\circ}$ R-1b-mole).
 - T_{m} = Absolute average dry-gas meter temperature (see Figure 6), K (*R).
 - T_s = Absolute average stack-gas temperature (see Figure 6), K (*R).
- T_{std} = Standard absolute temperature, 293K (528°R).
- Yic = Total volume of liquid collected in the organic module condensate knockout trap, the impingers, and silica gel, mL.
- V_{2} = Volume of gas sample as measured by dry-gas meter, dscm (dscf).
- Ym(std) = Volume of gas sample measured by the dry-gas meter, corrected to standard conditions, dscm (dscf).
- Vw(std) = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).
 - /s = Stack-gas velocity, calculated by Method 2, Equation 2-9, using
 data obtained from Method 5, m/sec (ft/sec).
 - W_a = Weight of residue in acetone wash, mg.
 - γ = Dry-gas-meter calibration factor, dimensionless.
 - ΔH = Average pressure differential across the orifice meter (see Figure 2), m_1 H₂O (in. H₂O).

og = Density of mater, 0.9932 g/mL (0.882101 %b/ %L).

- 3 Total sampling time, min.
- 32 Simpling time interval from the beginning of a run until the first component change, min.
- 3; = Sampling time interval between two successive component changes, beginning with the interval between the first and second changes, min.
- \Im_p = Sampling time interval from the final (n^{th}) component change until the end of the sampling run, min.
- 13.5 * Specific gravity of mercury.
 - 60 = sec/min.
- 100 = Conversion to percent.
- 10.3 Average dry-gas-meter temperature and average orifice pressure drop: See data sneet (Figure 5, above).
- 10.4 <u>Dry-gas volume</u>: Correct the sample measured by the dry-gas meter to standard conditions (20°C, 760 mm Hg [68°F, 29.92 in. Hg]) by using Equation 1:

$$V_{m(stid)} = V_{m7} \frac{T_{std}}{T_{m}} = \frac{P_{bar} + \Delta H/13.6}{P_{std}} = K_{1}V_{m7} \frac{P_{bar} + \Delta H/13.6}{T_{m}}$$
 (1)

where:

 $K_1 = 0.3858$ K/mm Hg for metric units, or $K_1 = 17.64$ °R/in. Hg for English units.

It should be noted that Equation 1 can be used as written, unless the leakage rate observed during any of the mandatory leak-checks (i.e., the post-test leak-check or leak-checks conducted prior to component changes) exceeds L_a . If L_0 or L_1 exceeds L_a , Equation 1 must be modified as follows:

a. Case I (no component changes made during sampling run): Replace V_m in Equation 1 with the expression:

$$V_{a} - (L_{p} - L_{a})$$

b. Case II (one or more component changes made during the sampling run): Replace Va in Equation 1 by the expression:

$$y_a - (L_1 - L_3)3_1 - \sum_{i=2}^{n} (L_1 - L_3)3_1 - (L_p - L_3)3_p$$

and substitute only for those leakage rates (L_1 or L_p) that exceed L_a .

10.5 Volume of water vapor:

$$\forall_{x(std)} = \forall_{1c} \frac{P_w}{\mu_w} \frac{RT_{std}}{P_{std}} = K_2 \forall_{1c}$$
 (2)

where:

 K_2 = 0.001333 m³/mL for metric units, or K_2 = 0.04707 ft³/mL for English units.

10.6 Moisture content:

$$3_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$
 (3)

NOTE: In saturated or water-droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 3) and a second from the assumption of saturated conditions. The lower of the two values of By shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note to Section 1.2 of Method 4. For the purposes of this method, the average stack-gas temperature from Figure 6 way be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1°C (2°F).

10.7 Conversion factors:

From	To m3	Hultiply by
scf	3 3	0.02832
g/ft ³	gr/ft ³	15.43
g/ft ³	1b/ft3	2.205 x 10 ⁻³
g/ft ³	g/ m 3	35.31

13.3 Inokinetic variatica:

10.3.1 Calculation from new data:

$$I = \frac{100 T_{3} [X_{3}F_{1c} + (Y_{.3}/T_{m}) (P_{bar} + \Delta H/13.6)]}{503Y_{3}P_{3}\lambda_{n}}$$
(4)

where:

 K_3 = 0.003454 mm Hg-m³/mL-K for metric units, or K_3 = 0.002569 in. Hg-ft³/mL-°2 for English units.

10.3.2 Calculation for intermediate values:

$$I = \frac{T_{3}V_{m}(std)P_{std}^{100}}{T_{std}V_{s}JA_{n}P_{s}60(1-B_{ws})}$$

$$= K_{4} \frac{T_{5}V_{m}(std)}{P_{5}V_{5}A_{3}B(1-B_{ws})}$$
(5)

where:

 K_4 = 4.320 for metric units, or K_4 = 0.09450 for English units.

- 10.3.3 Acceptable results: If $90\% \le I \le 110\%$, the results are acceptable. If the results are low in comparison with the standard and I is beyond the acceptable range, or if I is less than 90%, the Administrator may opt to accept the results.
- 10.9 To determine the minimum sample volume that shall be collected, the following sequence of calculations shall be used.
 - 10.9.1 From prior analysis of the waste feed, the concentration of PCHCs introduced into the combustion system can be calculated. The dagree of destruction and removal efficiency that is required is used to datarmine the maximum amount of PCHC allowed to be present in the effluent. This may be expressed as:

$$\frac{\text{(WF) (PCHC, conc) (100-NDRE)}}{100} = \text{Max PCHC, Mass} \qquad (6)$$

shere:

WF = mass flow rate of waste feed per hr, g/hr (lb/hr).

POHC₁ = concentration of Principal Organic Hazardous Compound (wt %) introduced into the combustion process.

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DRE = percent Destruction and Removal Efficiency required.

Max PCHC = mass flow rate (g/hr [lb/hr]) of PCHC emitted from the combustion source.

10.9.2 The average discharge concentration of the POHC in the effluent gas is determined by comparing the Max POHC with the volumetric flow rate being exhausted from the source. Volumetric flow rate data are available as a result of preliminary Method 1-4 determinations:

$$\frac{\text{Hax POHC}_1 \text{ Mass}}{\text{DV}_{\text{eff(std)}}} = \text{Hax POHC}_1 \text{ conc}$$
 (7)

where:

DVeff(std) * volumetric flow rate of exhaust gas, dscm (dscf).

POHC₁ conc = anticipated concentration of the POHC in the exhaust gas stream, g/dscm (lb/dscf).

10.9.3 In making this calculation, it is recommended that a safety margin of at least ten be included:

$$\frac{\text{LDL}_{\text{POHC}} \times 10}{\text{POHC}_{1} \text{ conc}} = V_{\text{TBC}} \tag{8}$$

where:

LDLpour = detectable amount of POHC in entire sampling train.

NOTE: The whole extract from an XAD-2 cartridge is seldom if ever, injected at once. Therefore, if aliquoting factors are involved, the LDLpour is not the same as the analytical (or column) detection limit.

Vinc - minimum dry standard volume to be collected at dry-gas - metar.

- 10.10 Concentration of any given POHC in the gaseous emissions of a combustion process:
- 1) Multiply the concentration of the POHC as determined in Method 8270 by the final concentration volume, typically 10 mL.
 - CPOHC (ug/mL) x sample volume (mL) = amount (ug) of POHC in sample (9)

Congress concentration of 20HC as analyzed by Hethod 8270.

- 2) Sum the amount of 2090 found in all samples associated with a single train.
- Total (ug) = XAO-2 (ug) + condensate (ug) + rinces (ug) + impinger (ug) (10)
 - 3) Divide the total ug found by the volume of stack gas sampled (m^3) .
 - (Total ug)/(train sample volume) = concentration of PCHC (ug/ m^3) (11)

11.0 CUALITY CONTROL

- 11.1 Simpling: See EPA Manual 500/4-77-027b for Method 5 quality control.
- includes the analysis of field and method blanks, procedure validations, incorporation of stable labeled surrogate compounds, quantitation versus stable labeled internal standards, capillary column performance checks, and external performance tests. The surrogate spiking compounds selected for a particular analysis are used as primary indicators of the quality of the analytical data for a wide range of compounds and a variety of sample matrices. The assessment of combustion data, positive identification, and quantitation of the selected compounds are dependent on the integrity of the samples received and the precision and accuracy of the analytical methods employed. The quality assurance procedures for this method are designed to monitor the performance of the analytical method and to provide the required information to take corrective action if problems are observed in laboratory operations or in field sampling activities.
 - 11.2.1 Field Blanks: Field blanks must be submitted with the samples collected at each sampling site. The field blanks include the sample bottles containing aliquots of sample recovery solvents, unused filters, and resin cartridges. At a minimum, one complete sampling train will be assembled in the field staging area, taken to the sampling area, and leak-cnecked at the beginning and end of the testing (or for the same total number of times as the actual test train). The filter housing and probe of the blank train will be heated during the sample test. The train will be recovered as if it were an actual test sample. No gaseous sample will be passed through the sampling train.
 - 11.2.2 Method blanks: A method blank must be prepared for each set of analytical operations, to evaluate contamination and artifacts that can be derived from glassware, reagents, and sample handling in the laboratory.
 - 11.2.3 Refer to Hethod 8270 for additional quality control considerations.

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12.0 METHOD PERFORMANCE

- 12.1 Method performance evaluation: Evaluation of analytical procedure for a selected series of compounds must include the sample-preparation procedures and each associated analytical determination. The analytical procedures should be challenged by the test compounds spiked at appropriate levels and carried through the procedures.
- 12.2 Method detection limit: The overall method detection limits (lower and upper) must be determined on a compound-by-compound basis because different compounds may exhibit different collection, retention, and extraction efficiencies as well as instrumental minimum detection limit (MDL). The method detection limit must be quoted relative to a given sample volume. The upper limits for the method must be determined relative to compound retention volumes (breakthrough).
- 12.3 Method precision and bias: The overall method precision and bias must be determined on a compound-by-compound basis at a given concentration level. The method precision value would include a combined variability due to sampling, sample preparation, and instrumental analysis. The method bias would be dependent upon the collection, retention, and extraction efficiency of the train components. From evaluation studies to date using a dynamic spiking system, method biases of -13% and -16% have been determined for toluene and 1,1,2,2-tetrachloroethane, respectively. A precision of 19.9% was calculated from a field test data set representing seven degrees of freedom which resulted from a series of paired, unspiked Semivolatile Organic Sampling trains (Semi-VOST) sampling emissions from a hazardous waste incinerator.

13.0 REFERENCES

- 1. Addendum to Specifications for Incinerator Testing at Federal Facilities, PHS, NCAPC, December 6, 1967.
- 2. Bursey, J., Homolya, J., McAllister, R., and McGangley, J., Laboratory and Field Evaluation of the Semi-VOST Method, Vols. 1 and 2, U.S. Environmental Protection Agency, EPA/600/4-851/075A, 075B (1985).
- 3. Martin, R.M., Construction Details of Isokinetic Source-Sampling Equipment, Research Triangle Park, NC, U.S. Environmental Protection Agency, April 1971, PB-203 060/BE, APTD-0581, 35 pp.
- 4. Rom, J.J., Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment, Research Triangle Park, NC, U.S. Environmental Protection Agency, March 1972, P8-209 022/8E, APTD-0576, 39 pp.
- 5. Schlickenrieder, L.M., Adams, J.W., and Thrun, K.E., Modified Method 5 Train and Source Assessment Sampling System: Operator's Manual, U.S. Environmental Protection Agency, EPA/600/8-85/003, (1985).

- 5. Shi manaya, R.F., Alliandents in the EPA Homography for Different Pfrot Fibe Coefficients and Dry Polecular Weights, Stack Sumpling News, 2:4-11 (October 1974).
- 7. U.S. Environmental Protection Agency, CFR 10 Part 60, Appendix A, Hethods 1-5.
- 3. Vollaro, R.F., A Survey of Commercially Available Instrumentation for the Heasurement of Low-Range Gas Velocities, Research Triangle Park, NC, U.S. Environmental Protection Agency, Emissions Heasurement Branch, November 1976 (unpublished paper).

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METHOD 0010, APPENDIX A

PREPARATION OF XAD-2 SORBENT RESIN

1.0 SCOPE AND APPLICATION

1.1 XAD-2 resin as supplied by the manufacturer is impregnated with a bicarbonate solution to inhibit microbial growth during storage. Both the salt solution and any residual extractable monomer and polymer species must be removed before use. The resin is prepared by a series of water and organic extractions, followed by careful drying.

2.0 EXTRACTION

2.1 Method 1: The procedure may be carried out in a giant Soxhlet extractor. An all-glass thimble containing an extra-coarse frit is used for extraction of XAD-2. The frit is recessed 10-15 mm above a grenellated ring at the bottom of the thimble to facilitate drainage. The resin must be carefully retained in the extractor cup with a glass-wool plug and stainless stabl screen because it floats on methylene chloride. This process involves sequential extraction in the following order.

Solvent

Procedure

Vater

Initial rinse: Place resin in a beaker, rinse once with Type II water, and discard. Fill with water a second time, let stand overnight, and discard.

Water

Extract with H2O for 8 hr.

Methyl alcohol

Extract for 22 hr.

Methylene chloride

Extract for 22 hr.

Methylene chloride (fresh)

Extract for 22 hr.

2.2 Method 2:

2.2.1 As an alternative to Soxhlet extraction, a continuous extractor has been fabricated for the extraction sequence. This extractor has been found to be acceptable. The particular canister used for the apparatus shown in Figure A-1 contains about 500 g of finished XAD-2. Any size may be constructed; the choice is dependent on the needs of the sampling programs. The XAD-2 is held under light spring tension between a pair of coarse and fine screens. Spacers under the bottom screen allow for even distribution of clean solvent. The three-necked flask should be of sufficient size (3-liter in this case) to hold solvent

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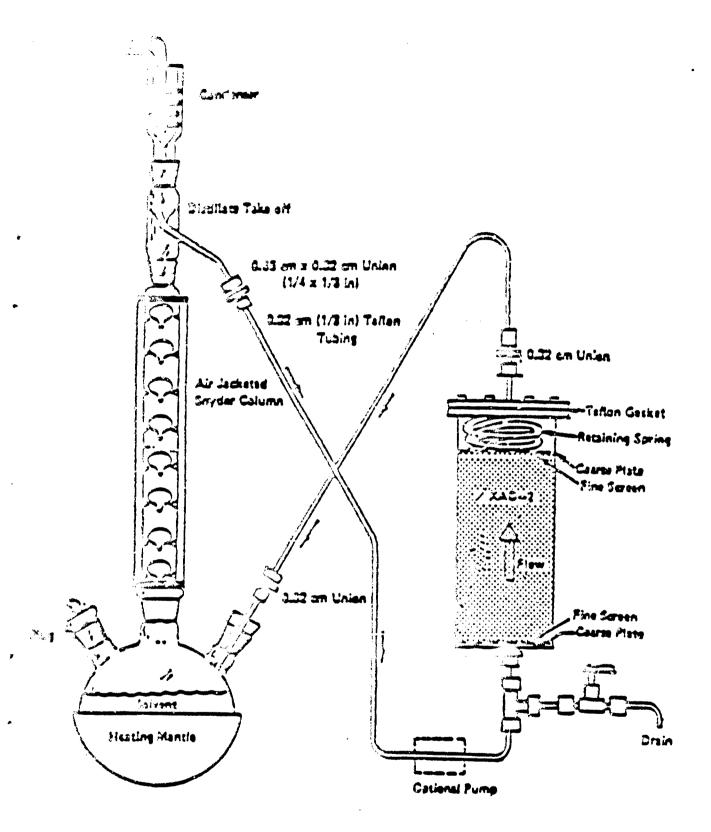


Figure A-1. XAD-2 cleanup extraction apparatus.

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Revision 0 Data <u>Sentember 1986</u> equal to twice the dead volume of the XAD-2 canister. Solvent is refluxed through the Snyder column, and the distillate is continuously cycled up through the XAD-2 for extraction and returned to the flask. The flow is maintained upward through the XAD-2 to allow maximum solvent contact and prevent channeling. A valve at the bottom of the canister allows removal of solvent from the canister between changes.

- 2.2.2 Experience has shown that it is very difficult to cycle sufficient water in this mode. Therefore the aqueous rinse is accomplished by simply flushing the canister with about 20 liters of distilled water. A small pump may be useful for pumping the water through the canister. The water extraction should be carried out at the rate of about 20-40 mL/min.
- 2.2.3 After draining the water, subsequent methyl alcohol and methylene chloride extractions are carried out using the refluxing apparatus. An overnight or 10- to 20-hr period is normally sufficient for each extraction.
- 2.2.4 All materials of construction are glass, Teflon, or stainless steel. Pumps, if used, should not contain extractable materials. Pumps are not used with methanol and methylene chloride.

3.0 DRYING

- 3.1 After evaluation of several methods of removing residual solvent, a fluidized-bed technique has proved to be the fastest and most reliable drying method.
- 3.2 A simple column with suitable retainers, as shown in Figure A-2, will serve as a satisfactory column. A 10.2-cm (4-in.) Pyrex pipe 0.6 m (2 ft) long will hold all of the XAD-2 from the extractor shown in Figure A-1 or the Soxhlet extractor, with sufficient space for fluidizing the bed while generating a minimum resin load at the exit of the column.
 - 3.3 Method 1: The gas used to remove the solvent is the key to preserving the cleanliness of the XAD-2. Liquid nitrogen from a standard commercial liquid nitrogen cylinder has routinely proved to be a reliable source of large volumes of gas free from organic contaminants. The liquid nitrogen cylinder is connected to the column by a length of precleaned 0.95-cm (3/3-in.) copper tubing, coiled to pass through a heat source. As nitrogen is bled from the cylinder, it is vaporized in the heat source and passes throughthe column. A convenient heat source is a water bath heated from a steam line. The final nitrogen temperature should only be warm to the touch and not over 40°C. Experience has shown that about 500 g of XAD-2 may be dried overnight by consuming a full 160-liter cylinder of liquid nitrogen.
 - 3.4 Hethod 2: As a second choice, high-purity tank nitrogen may be used to dry the XAD-2. The high-purity nitrogen must first be passed through a bed

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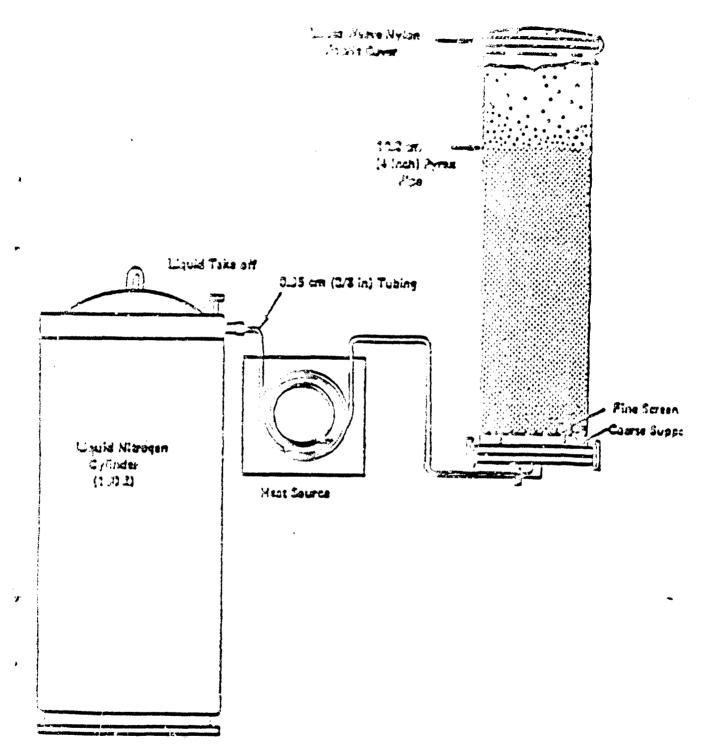


Figure A-2. XAD-2 fluidized-bed drying apparatus.

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of activated charcoal approximately 150 mL in volume. With either type of drying method, the rate of flow should gently agitate the bed. Excessive fluidization may cause the particles to break up.

3.0 QUALITY CONTROL PROCEDURES

- 4.1 For both Methods 1 and 2, the quality control results must be reported for the batch. The batch must be reextracted if the residual extractable organics are >20 ug/mL by TCO analysis or the gravimetric residue is >0.5 mg/20 g XND-2 extracted. (See also section 5.1, Method 0010.)
- 3.2 Four control procedures are used with the final XAD-2 to check for (1) residual methylene chloride, (2) extractable organics (TCO), (3) specific compounds of interest as determined by GC/AS, as described in Section 4.5 below, and (4) residue (GRAV).

4.3 Procedure for residual methylene chloride:

- 4.3.1 Description: A 1+0.1-g sample of iried resin is weighed into a small vial, 3 mL of toluene are added, and the vial is capped and well shaken. Five uL of toluene (now containing extracted methylene chloride) are injected into a gas chromatograph, and the resulting integrated area is compared with a reference standard. The reference solution consists of 2.5 uL of methylene chloride in 100 mL of toluene, simulating 100 ug of residual methylene chloride on the resin. The acceptable maximum content is 1,000 ug/g resin.
- 4.3.2 Experimental: The gas chromatograph conditions are as follows:

6-ft x 1/8-in. stainless steel column containing 10% OV-101 on 100/126 Supelcoport;

Helium carrier at 30 mL/min;

FID operated on 4 x 10^{-11} A/mV;

Injection port temperature: 250°C;

Detector temperature: 305°C:

Program: 30°C(4 min) 40°C/min 250°C (hold); and

Program terminated at 1,000 sec.

4.4 Procedure for residual extractable organics:

4.4.1 Description: A 20±0.1-g sample of cleaned, dried resin is resigned into a precleaned alundum or cellulose thimble which is plugged with cleaned glass wool. (Note that 20 g of resin will fill a thimble, and the

resin will float out unless well plugged.) The thible containing the resin is extracted for 24 hr with 200-aL of posticide-grade methylene chloride (Burdick and Jackson pesticide-grade or equivalent purity). The 200-aL extract is reduced in volume to 10-aL using a Kuderna-Danish concentrator and/or a nitrogen evaporation stream. Five uL of that solution are analyzed by gas chromatography using the TCO analysis procedure. The concentrated solution should not contain >20 ug/aL of TCO extracted from the XAD-2. This is equivalent to 10 ug/g of TCO in the XAD-2 and would correspond to 1.3 mg of TCO in the extract of the 130-g XAD-2 module. Care should be taken to correct the TCO data for a solvent blank prepared (200 rL reduced to 10 mL) in a similar manner.

- 4.4.2 Experimental: Use the TCO analysis conditions described in the revised Level 1 manual (EPA 600/7-78-201).
- 4.5 GC/MS Screen: The extract, as prepared in paragraph 4.4.1, is subjected to CC/MS analysis for each of the individual compounds of interest. The GC/MS procedure is described in Chapter Four, Method 8270. The extract is screened at the MDL of each compound. The presence of any compound at a concentration >25 ug/mL in the concentrated extract will require the XAD-2 to be recleaned by repeating the methylene chloride step.
- 4.5 <u>Methodology for residual gravimetric determination</u>: After the TCO value and GC/MS data are obtained for the resin batch by the above procedures, dry the remainder of the extract in a tared vessel. There must be <0.5 mg residua registered or the batch of resin will have to be extracted with fresh methylene chloride again until it meets this criterion. This level corresponds to 25 mg/g in the XAD-2, or about 3.25 mg in a resin charge of 130 g.

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METHOD 0010, APPENDIX 3

TOTAL CHRCMATCGRAPHABLE ORGANIC_MATERIAL ANALYSIS

1.0 SCOPE AND APPLICATION

1.1 In this procedure, gas chromatography is used to determine the quantity of lower boiling hydrocarbons (boiling points between 90° and 300°C) in the concentrates of all organic solvent rinses, XAD-2 resin and LC fractions - when Method 1 is used (see References, Method 0010) - encountered in Level 1 environmental sample analyses. Data obtained using this procedure serve a twofold purpose. First, the total quantity of the lower boiling hydrocarbons in the sample is determined. Then whenever the hydrocarbon concentrations in the original concentrates exceed 75 ug/m³, the chromatography results are reexamined to determine the amounts of individual species.

The extent of compound identification is limited to representing all materials as normal alkanes based upon comparison of boiling points. Thus the method is not qualitative. In a similar manner, the analysis is semiquantitative; calibrations are prepared using only one hydrocarbon. They are replicated but samples routinely are not.

- 1.2 <u>Application</u>: This procedure applies solely to the Level 1 C7-C16 gas chromatographic analysis of concentrates of organic extracts, neat liquids, and of LC fractions. Throughout the procedure, it is assumed the analyst has been given a properly prepared sample.
- 1.3 Sensitivity: The sensitivity of this procedure, defined as the slope of a plot of response versus concentration, is dependent on the instrument and must be verified regularly. TRW experience indicates the nominal range is of the order of 77 uV·V·sec·uL/ng of n-heptane and 79 uV·sec·ul/ng of n-hexadecane. The instrument is capable of perhaps one hundredfold greater sensitivity. The level specified here is sufficient for Level 1 analysis.
- 1.4 Detection limit: The detection limit of this procedure as written is 1.3 ng/uL for a 1 uL injection of n-decane. This limit is arbitrarily based on defining the minimum detectable response as 100 uv-sec. This is an easier operational definition than defining the minimum detection limit to be that amount of material which yields a signal twice the noise level.
- 1.5 Range: The range of the procedure will be concentrations of 1.3 ng/uL and greater.

1.6 Limitations

1.6.1 Reporting limitations: It should be noted that a typical environmental sample will contain compounds which: (a) will not elute in the specified boiling ranges and thus will not be reported, and/or (b)

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will not slute from the column at all and thus will not be reported. Consequently, the organic content of the sample as reported is a lower bound and should be regarded as such.

- 1.8.2 Calibration limitations: Quantitation is based on calibration with n-decane. Data should therefore be reported as, e.g., and C3/m³ as n-decane. Since response varies linearly with carbon number (over a wide range the assumption may involve a 20% error), it is clear that heptane (C7) detected in a sample and quantitated as decane will be overestimated. Likewise, hexadecane (C16) quantitated as decane will be underestimated. From previous data, it is estimated the error involved is on the order of 6-7%.
- 1.6.3 Detection limitations: The sensitivity of the flame ionization detector varies from compound to compound. However, n-alkanes have a greater response than other classes. Consequently, using an n-alkane as a calibrant and assuming equal responses of all other compounds tends to give low reported values.

2.0 SUMMARY OF METHOD

- 2.1 A mL aliquot of all 10-mL concentrates is disbursed for GC-TCO analysis. With boiling point-retention time and response-amount calibration curves, the data (peak retention times and peak areas) are interpreted by first summing peak areas in the ranges obtained from the boiling point-retention time calibration. Then, with the response-amount calibration curve, the area sums are converted to amounts of material in the reported boiling point ranges.
- 2.2 After the instrument is set up, the boiling point-retention time calibration is effected by injecting a mixture of n-C7 through n-C16 hydrocarbons and operating the standard temperature program. Response-quantity calibrations are accomplished by injecting n-decame in n-pentane standards and performing the standard temperature program.

2.3 Definitions

- 2.3.1 aC: Gas chromatography or gas chromatograph.
- 2.3.2 C7-C16 n-alkanes: Heptane through hexadecane.
- 2.3.3 SCA temperature program: 4 min isothermal at 60°C, 10°C/min from 60° to 220°C.
- 2.3.4 TRY temperature program: 5 min isothermal at room temperature, then program from 30°C to 250°C at 15°C/min.

3.C INTERFERENCES

Hot applicable.

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4.0 APPARATUS AND MATERIALS

4.1 <u>Gas chromatograph</u>: This procedure is intended for use on a Varian 1350 gas chromatograph, equipped with dual flame ionization detectors and a linear temperature programmer. Any equivalent instrument can be used provided that electrometer settings, etc., be changed appropriately.

4.2 Gasas:

- 4.2.1 Helium: Minimum quality is reactor grade. A 4A or 13X molecular sieve drying tube is required. A filter must be placed between the trap and the instrument. The trap should be recharged after every third tank of helium.
 - 4.2.2 Air: Zero grade is satisfactory.
 - 4.2.3 !!ydrogen: Zero grade.
- 4.3 Syringe: Syringes are Hamilton 701N, 10 uL, or equivalent.
- 4.4 Septa: Septa will be of such quality as to produce very low bleed during the comperature program. An appropriate septum is Supelco Microsep 133, which is leflon-backed. If septum bleed cannot be reduced to a negligible level, it will be necessary to install septum swingers on the instrument.
- 4.5 Recorder: The recorder of this procedure must be capable of not less than 1 mV rull-scale display, a 1-sec time constant and 0.5 in. per min chart rate.
- 4.6 <u>Integrator</u>: An integrator is required. Peak area measurement by hand is satisfactory but too time-consuming. If manual integration is required, the method of "height times width at half height" is used.

4.7 Columns:

- 4.7.1 Preferred column: 6 ft x 1/3 in. 0.D. stainless steel column of 10% OV-101 on 100/120 mesh Supelcoport.
- 4.7.2 Alternate column: 6 ft x 1/3 in. 0.D. stainless steel column of 10% OV-1 (or other silicon phase) on 100/120 mesh Supelcoport.
- 4.8 Syringe cleaner: Hamilton syringe cleaner or equivalent connected to a suitable vacuum source.

5.0 REAGENTS

5.1 <u>Pentane</u>: "Distilled-in-Glass" (reg. trademark) or "Nanograde" (reg. trademark) for standards and for syringe cleaning.

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3.2 Pathylane chloride: "Distilled-in-Glass" (req. trademark) or "Discourses" (req. trademark) for syringe cleaning.

5.0 SAMPLING HANDLING AND PRESERVATION

6.1 The extracts are concentrated in a Kuderna-Danish evaporator to a volume less than 10 mL. The concentrate is then quantitatively transferred to a 10-mL volumetric flask and diluted to volume. A 1-mL aliquot is taken for both this analysis and possible subsequent GC/MS analysis and set aside in the sample bank. For each GC-TCO analysis, obtain the sample sufficiently in advance to allow it to warm to room temperature. For example, after one analysis is started, return that sample to the sample bank and take the next sample.

7.0 PROCEDURES

- 7.1 Setup and checkout: Each day, the operator will verify the following:
 - 7.1.1 That supplies of carrier gas, air and hydrogen are sufficient, i.e., that each tank contains > 100 psig.
 - 7.1.2 That, after replacement of any gas cylinder, all connections leading to the chromatograph have been leak-checked.
 - 7.1.3 That the carrier gas flow rate is 30 ± 2 mL/min, the hydrogen flow rate is 30 ± 2 mL/min, and the air flow rate is 300 ± 20 mL/min.
 - 7.1.4 That the electrometer is functioning properly.
 - 7.1.5 That the recorder and integrator are functioning properly.
 - 7.1.6 That the septa have been leak-checked (leak-checking is effected by placing the soap bubble flow meter inlet tube over the injection port adaptors), and that no septum will be used for more than 20 injections.
 - 7.1.7 That the list of samples to be run is ready.

7.2 Retention time calibration:

7.2.1 To obtain the temperature ranges for reporting the results of the analyses, the chromatograph is given a normal boiling point-retention time calibration. The n-alkanes, their boiling points, and data reporting ranges are given in the table below:

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	332,°C	Ascorting Range, "C	Riport As
n-heptane	98	90-110	C7
n-octane	125	110-140	ČŠ
n-nonane	151	140-160	Č
n-decane	174	150-130	C16
n-undecane	194	130-200	C11
n-dodecane	214	200-220	C12
n-tridecone	234	220-240	C13
n-catradadane	252	289 -260	C14
n-pentadacane	270	250 -280	C15
n-hexadecone	228	230-300	C15

- 7.2.2 Preparation of standards: Preparing a mixture of the C7-C15 alkanes is required. There are two approaches: (1) use of a standards kit (e.g., Polyscience Kit) containing bottles of mixtures of selected nalkanes which may be combined to produce a C7-C16 standard; or (2) use of bottles of the individual C7-C16 alkanes from which accurately known volumes may be taken and combined to give a C7-C16 mixture.
- 7.2.3 Procedure for retention time calibration: This calibration is performed at the start of an analytical program; the mixture is chromatographed at the start of each day. To attain the required retention time precision, both the carrier gas flow rate and the temperature program specifications must be observed. Details of the procedure depend on the instrument being used. The general procedure is as follows:
 - 7.2.3.1 Set the programmer upper limit at 250°C. If this setting does not produce a column temperature of 250°C, find the correct setting.
 - 7.2.3.2 Set the programmer lower limit at 30°C.
 - 7.2.3.3 Verify that the instrument and samples are at room temperature.
 - 7.2.3.4 Inject 1 uL of the n-alkane mixture.
 - 7.2.3.5 Start the integrator and recorder.
 - 7.2.3.6 Allow the instrument to run isothermally at room temperature for five min.
 - 7.2.3.7 Shut the oven door.
 - 7.2.3.8 Change the mode to Automatic and start the temperature program.
 - 7.2.3.9 Repeat Steps 1-9 a sufficient number of times so that the relative standard deviation of the retention times for each peak is $\langle 5x \rangle$.

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7.3 Response calibration:

- 7.3.1 For the purposes of a Level 1 analysis, response-quantity calibration with n-decane is adequate. A 10-uL volume of n-decane is injected into a tared 10 mL volumetric flask. The weight injected is obtained and the flask is diluted to the mark with n-pentane. This standard contains about 730 ng n-decane per uL n-pentane. The exact concentration depends on temperature, so that a weight is required. Two serial tenfold dilutions are made from this standard, giving standards at about 730, 73, and 7.3 ng n-decane per uL n-pentane, respectively.
- 7.3.2 Procedure for response calibration: This calibration is performed at the start of an analytical program and monthly thereafter. The most concentrated standard is injected once each day. Any change in calibration necessitates a full calibration with new standards. Standards are stored in the refrigerator locker and are made up monthly.
 - 7.3.2.1 Verify that the instrument is set up properly.
 - 7.3.2.2 Set electrometer at 1 x 10^{-10} A/mV.
 - 7.3.2.3 Inject 1 uL of the highest concentration standard.
 - 7.3.2.4 Run standard temperature program as specified above.
 - 7.3.2.5 Clean syringe.
 - 7.3.2.6 Make repeated injections of all three standards until the relative standard deviations of the areas of each standard are 5.34.

7.4 Sample analysis procedure:

- 7.4.1 The following apparatus is required:
 - 7.4.1.1 Gas chromatograph set up and working.
 - 7.4.1.2 Recorder, integrator working.
 - 7.4.1.3 Syringe and syringe cleaning apparatus.
- 7.4.1.4 Parameters: Electrometer setting is 1×10^{-10} A/mV; recorder is set at 0.5 in./min and 1 mV full-scale.
- 7.4.2 Steps in the procedure are:
 - 7.4.2.1 Label chromatogram with the data, sample number, etc. .

- 7.4.2.2 Inject sample.
- 7.4.2.3 Start integrator and recorder.
- 7.4.2.4 After isothermal operation for 5 min, begin temperature program.
 - 7.4.2.5 Clean syringe.
 - 7.4.2.6 Return sample; obtain new sample.
- 7.4.2.7 When analysis is finished, allow instrument to cool. Turn chromatogram and integrator output and data sheet over to data analyst.

7.5 Syringe cleaning procedure:

- 7.5.1 Remove plunger from syringe.
- 7.5.2 Insert syringe into cleaner; turn on aspirator.
- 7.5.3 Fill pipet with pentane; run pentane through syringe.
- 7.5.4 Repeat with methylene chloride from a separate pipet.
- 7.5.5 Flush plunger with pentane followed by methylene chloride.
- 7.5.6 Repeat with methylane chloride.
- 7.6 Sample analysis decision criterion: The data from the TCO analyses of organic extract and rinse concentrates are first used to calculate the total concentration of C7-C16 hydrocarbon-equivalents (Paragraph 7.7.3) in the sample with respect to the volume of air actually sampled, i.e., ug/m^3 . On this basis, a decision is made both on whether to calculate the quantity of each n-alkane equivalent present and on which analytical procedural pathway will be followed. If the total organic content is great enough to warrant continuing the analysis >500 ug/m^3 a TCO of less than 75 ug/m^3 will require only LC fractionation and gravimetric determinations and IR spectra to be obtained on each fraction. If the TCO is greater than 75 ug/m^3 , then the first seven LC fractions of each sample will be reanalyzed using this same gas chromatographic technique.

7.7 Calculations:

- 7.7.1 Boiling Point Retention Time Calibration: The required data for this calibration are on the chromatogram and on the data sheet. The data reduction is performed as follows:
 - 7.7.1.1 Average the retention times and calculate relative standard deviations for each n-hydrocarbon.

- 7.7.1.2 Plot average retantion times as abscissae wersus normal boiling points as ordinates.
 - 7.7.1.3 Draw in calibration curve.
- 7.7.1.4 Locate and record retention times corresonding to boiling ranges 90-100, 110-140, 140-160, 160-180, 180-200, 200-220, 220-240, 240-250, 260-280, 280-300°C.
- 7.7.2 Response-amount calibration: The required data for this calibration are on the chromatogram and on the data sheet. The data reduction is performed as follows:
 - 7.7.2.1 Average the area responses of each standard and calculate relative standard deviations.
 - 7.7.2.2 Plot response (uv-sec) as ordinate versus ng/uL as abscissa.
 - 7.7.2.3 Draw in the curve. Perform least squares regression and obtain slope (uV-sec-uL/ng).
- 7.7.3 Total C7-C16 hydrocarbons analysis: The required data for this calculation are on the chromatogram and on the data sheet. The data reduction is performed as follows:
 - 7.7.3.1 Sum the areas of all peaks within the retention time range of interest.
 - 7.7.3.2 Convert this area (uV-sec) to ng/uL by dividing by the weight response for n-decame (uV-sec.uL/ng).
 - 7.7.3.3 Hultiply this weight by the total concentrate volume (10 mL) to get the weight of the C7-C16 hydrocarbons in the sample.
 - 7.7.3.4 Using the volume of gas sampled or the total weight of sample acquired, convert the result of Step 7.7.3.3 above to ug/m^3 .
 - 7.7.3.5 If the value of total C7-C18 hydrocarbons from Step 7.7.3.4 above exceeds 75 ug/m³, calculate individual hydrocarbon concentrations in accordance with the instructions in Paragraph 7.7.5.5 below.
- 7.7.4 Individual C7-C16 n-Alkane Equivalent Analysis: The required data from the analyses are on the chromatogram and on the data sheet. The data reduction is performed as follows:
 - 7.7.4.1 Sum the areas of peaks in the proper retention time ranges.

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- 7.7.5.2 Convert areas (uV-sec) to ng/uL by dividing by the proper weight response (uV-sec-uL/ng).
- 7.7.4.3 Multiply each weight by total concentrate volume (10 mL) to get weight of species in each range of the sample.
- 7.7.4.4 Using the volume of gas sampled on the total weight of sample acquired, convert the result of Step 7.7.4.3 above to ug/m^3 .

8.0 CUALITY CONTROL

8.1 Appropriate QC is found in the pertinent procedures throughout the method.

9.0 METHOD PERFORMANCE

9.1 Even relatively comprehensive error propagation analysis is beyond the scope of this procedure. With reasonable care, peak area reproducibility of a standard should be of the order of 1% RSD. The relative standard deviation of the sum of all peaks in a fairly complex waste might be of the order of 5-10%. Accuracy is more difficult to assess. With good analytical technique, accuracy and precision should be of the order of 10-20%.

10.0 REFERENCES

1. Emissions Assessment of Conventional Stationary Combustion Systems: Methods and Procedure Manual for Sampling and Analysis, Interagency Energy/Environmental R&D Program, Industrial Environmental Research Laboratory, Research Triangle Park, NC 27711, EPA-600/7-79-029a, January 1979.

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EPA METHOD 5

DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

MICTHOR 5—DETERMINATION OF PARVICULATE ENLISHONS PROM STATIONARY SOURCES

1. Principle and Applicability

1.1 Principle, Particulate matter is with-drawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120±14°C (1248±25°F) or such other temperature as specified by an applicable subpart of the standards or approved by Administrator, U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined travimentically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. Apparatus

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTO-0581 (Citation 2 in Bibliography); commercial models of this train are also available. For changes from APTO-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The oberating and maintenance procedures for the sampling train are described in ATTD-0578 (Citation 3 in Philography). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified hyrem. The sampling train consists of the following components:

2.1.1 Probe Nozzle. Stainless steel (3.18) or glass with sharp, tapered leading edge. The angle of taper shall be <0° and the taper shall be <0° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tuning other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzic sizes suitable for isokinetic tampling should be available, e.g., 0.32 to 1.27 cm. (% to % in.)—or larger if higher volume sampling trains are used—inside diameter (ID) nozzies in increments of 0.18 cm (% in.). Each nozzie shall be callbrated according to the procedures outlined in Section 5.

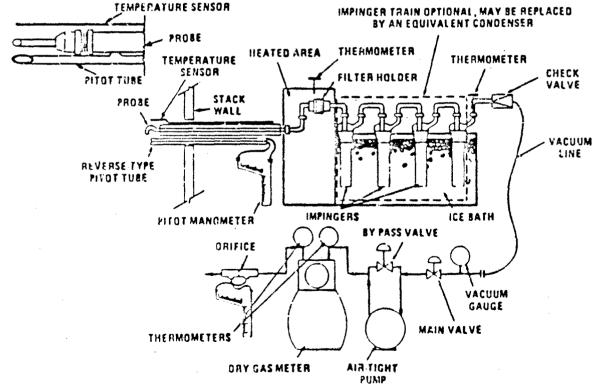
2.1.2 Prope Liner, Borosilicate or quartz glass tubing with a heating system capableof maintaining a gas temperature at the exit end during sampling of 120 = 14° C (248 = 25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified I Since the actual temperature at the outlet of the prope is usually monitored during sampling. probes constructed according to APTO-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480° C (900° F) quartz liners shall be used for temperatures between 430 and 900° C (900 and 1,650° F). Both types of liners may be used at higher temperatures than specified for short peniods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820° C (1,508° F), and for quartz it is 1,500° C (2,732° F).

Whenever practical, every effort should be made to use borosilicate or quartz glass problemers. Alternatively, metal liners (e.g., Ji6 liamiess steel Intoloy 825,1 or other corrosion resultant in als) made of seamless tubing may be used, subject to the approval of the Administrator.

2.1.3 Pitot Tube. Type S. as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

*Mention of trade names or specific product uses not constitute endorsement by the Environmental Protection Agency.



Pigure 8-1, Particulate sampling train.

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- 2.1.4 Differentia Pressure Gauge, Indined manometer or equivalent device two), as described in Section 2.2 of Method 2. One manometer shall be used or velocity than (25) readings, and the other, for onfice lifferentia pressure readings.
- 2.1.5 Filter Holder. Borosilicate gissa, with a glass firt filter support and a silicone subber gasget. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, it used).
- 2.1,3 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during samining of 120=14° C (288±25° F), or such their temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature ower than that specified. A temperature fauze capable of measuring temperature to within 3° C (5.4° F) shall be installed so that he temperature around the filter holder and he represents systems other than the one hown in APTD-0581 may be used.
- 2.1.7 Condenser. The following system hall be used to determine the stack cas noisture content: Pour impiliers connected n series with leak-free ground glass fittings ir any similar leax-free non-contaminating ittings. The first, third, and fourth imsingers shall be of the Greenburg-Smith lesion, modified by replacing the tip with .3 cm (% in.) ID glass tube extending to bout 1.3 cm (W un.) from the housans of the lask. The second impinger shall ce of the Preenburg-Smith design with the standard in. Modifications (e.g., using flexible conlections between the impingers, using matetals other than glass, or using flexible scuum lines to connect the filter holder to ne condenser) may be used, subject to the oproval of the Administrator. The first and econd impingers snall contain known quanities of water (Section 4.1.3), the third shall e empty, and the fourth shall contain a nown weight of silica get, or equivalent esiccant. A intermometer, capable of measring temperature to within if C (2° P) shall e placed at the outlet of the fourth impingr for monitoring purposess.

Alternatively, any system that cools the ample gas stream and thows measurement if the water concensed and moisture leavng the condenser, each to within 1 ml or 1 g may be used, supject to the approval of time Administrator. Acceptable means are to nessure the congensed water either mayinetrically or volumetrically and to measure he mouture leaving the condenses by: (1) conitoring the temperature and pressure at he exit of the condenser and using Dalton's aw of partial pressures; or (3) passing the ample has stream through a tared stiles and or equivalent designant) trap with exit uses kept below 20' C (68' Y) and determinng the weight gwal

If means other than silica set are used to letermine the annulit of moisture leaving he condenser, it is recommended that ulica et (or equivalent) still be used netween the ondenser system and pump to prevent noisture condensation in the pump and merring devices and to avoid the need to make orrections for moisture in the instered niture.

Note If a determination of the particulate matter consected in the impurgers is desired in addition to moisture content, the impurger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impurger contents.

2.1.3 Metering System. Vacuum gauge, leax-free pump, thermometers mapable of measuring temperature to within 5° C (3.3° P), dry gas meter capable of measuring volume to within 2 percent, and reinted equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isoxinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isoxinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that decribed in APTD-0581 or APDT-0578 may be used provided that the specializations of this method are met.

- 2.1.9 Barometer. Mercury aneroid, or other barometer capacie of measuring atmospheric pressure to within 2.5 mm lig (0.1 in, Hg). In many cases the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for clevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in, Hg) per 30 m (100 it) slevation increase or vice versa for elevation decrease.
- 2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading educ of the probe sheath and does not touch sar metal. Alternatively, the sensor may be attached just prior to use in the fleid. Note. however, that if the temperature sensor is attached in the field, the sensor must be places, in an interference-free arrangement with respect to the Type S pitot tube openings (see Mathod 2, Pigure 2-7). As a second alternative, if a difference of not more than I percent in the average velocity measurement is to be introduced, the temperature rauge need not be attached to the probe or pitot tune (This alternative is subject to the approval of the Administrator.)
- 2.2 Sample Recovery. The following items are needed.
- 2.2.1 Probe-Liner and Probe-Nossie Brushes. Nylon bristle brushes with standless stees were handles. The probe brush shall nave extensions (at least as long as the probe) of stainings steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nossie.
- 2.2.2 Waan Sottles—Two. Olass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that account not be stored in polyethylene bottles for longer than a month.

- 2.2.1 Class Tample Storage Containers Chemically resistant, borosilicate glass bot ties, for acetone assumes, 500 mi or 1000 mi Sorew cap liners small either be rupper-backed Teilon or small be constructed so as to be less-free and resistant to chemical attack by acetone. Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.
- 2.2.4 Petri Disnes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.
- 2.2.5 Graduated Cylinder and/or Balance. To measure concensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable or use here and in Section 2.2.4.
- 2.26 Plastic Storage Containers, Airtight containers to store silica gel.
- 2.2.7 Funnet and Rubber Policeman. To aid in trans.er of silica gel to container; not
- 2.23 Punnel Glass or polyethylene, to aid in sample recovery.
- 2.2 Analysis. For analysis, the following equipment is needed.
- 2.5.1 Glass Weighing Dishes.
- 2.3.2 Desturator.
- 2.3. Analytical Balance. To measure to within 0.1 mg.
- 23.4 Balance. To measure to within 0.5 &
- 235 Beakers 250 ml
- 2.3.8 Hygrometer. To measure the relative numurity of the laboratory environment.
- 23.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. Reavents

- 3.1 Sampling. The reagents used in sampling are so lollows:
- 3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 9.3-micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71 (Resported 1978) (Incorporated by reference—see § 60.17). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing 3O₆ or 3O₆, the filter material must be of a type that is unreactive to SO₆ or 3O₆. Citation 10 in Section 7 Bibliography, may be used to select the appropriate filter.
- 3.1.2 Blics Cel. indicating type, 6 to 16 mesh. If previously used, dry at 175° C (3.50° P) for 2 hours. New silics gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.
- 3.1.3 Water, When analysis of the material cought in the impingers is required, distilled water shall be used. Run blanks prior to ifrid use to eliminate a high blank on test samoles.
- 3.1.4 Crushed Ios.
- 3.1.5 Stopcock Greass. Acetone-insoluble, iteat-stable suitone greass. This is not necessary if screw-on connectors with Teflon sieves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

if, however, a higher leasing rate is onasped, the tester shall either record the leakage rate and plan to correct the sample volume se shown in Section 6.3 of this method, or shall void the sampling run

Immediately after component changes, leak-checks are opcional; if such leak-checks are done, the procedure outlined in Section

4.1.4.1 above souli by used

4.1.4.2 Property Lank-Check A look check is mandatory at the conclusion of each campling run. The leaktheen shall be done in accordance with the procedures outlined in Section 4.2.4.1, except that it shall be conducted at a recutte equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 9.90057 m'/min (0.02 cfm) or 4 Lerosat of the average sampling rate (whichers, is less), the results are acceptable, and no correction need be anpiled to the total rolume of dry and metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and cerrect the sample volume as shown in Section 6.3 of this method, or

shall void the sampling run.
4.1.5 Perticulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120=14° C (248=25° P). or such other temperature as specified by an applicable subpart of the standards of approved by the Administrator.

For each run, record the data required on data short such as the one shown in Figure 5-2. He sure to record the initial dry gas motor reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes is flow rates are made, before and after each leak-check, and whos sampling is halted Take other resource required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings; necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks disting the traverse.

Clean the porthoise prior to the test run to minimize the chance of sampling deposited material. To begin sympling, remove the notice cap, verify that are filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isotinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85±0.02, and the stack are equivalent density (dry molecular weight) is equal to 20±4. APTD-0576 details the precedure for using the nemographs. If C, and M, are out-side the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impensor stam). take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve

When the probe is in position, block c the openition around the probe and porthe to prevent unrepresentative dilution of the

gas stream.

Traverse the stack cross-section, as r quired by Method I or as specialed by th Administrator, being careful not to bur the probe notice into the stack walls whe sampling near the walls or when remover or inserting the probe through the por holes: this minimuses the chance of extrac ing deposited material.

During the test run, make periodic adjus ments to keep the temperature around th filter holder at the proper level; add mor ice and, if necessary, sait to maintain a tem perature of less than 20° C (68° P) at th condenser/silics gel outlet. Also, periodics ly check the level and sero of the manonic

If the pressure drop across the filter be comes too high, making isoxinetic samplin difficult to maintain, the filter may be re placed in the midst of a sample run. It i recommended that another complete filte assembly be used rather than attempting t change the filter itself. Before a new filte assembly is installed conduct a leak-chec (see Section 4.1.4.2). The total particular weight shall include the summation of a filter amountir catch

A single train shall be used for the entir manple run, except in cases where simults neous sampling is required in two or mor separate ducts of at two or more differen extions within the same duct, or, in case where equipment failure necessitates change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

FIGURE 5-2-PARTICULATE MELD DATA

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373 Sample Recovery. Acutone-reagent arrade, culcul percent residue, in glass bottlemes required acutone from metal con-

Hers generally has a high residue blank and thould rost on used. Sometimes, suppliers transfer acretone to glass bottles from metal contributes thus, acetone blanks shall be run prior to field use and only acetone with nor mank values (c0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample wright.

3.3 Analysis. Two reagents are required for the analysis.

3.3.1 Acetone. Same as 3.2.

1.3.2 Desiceant Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiceants may be used, subject to the approval of the Administrator.

4. Procedure

- 4.1 Sampling. The complexity of this method is such that in order to obtain reliable results. testers should be trained and experienced with the test procedures.
- 4.1.1 Pretest Preparation. It is suggested that campling equipment be mean anneal according to the procedures described in APTO-0578.

Weigh several 200 to 300 g portions of silica gai in air-tight containers to the nearest 0.5 g. Recurd the total weight of the sulfar gai pius container, on each container. As an alternative, the silica gai need not be proweighed, but may be weighed directly in the impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leass. Label filters of the proper diameter on the back side near the edge using numbering machine max has an alternative, label the shipping containers (glass or plastic petri disters) and keep the filters in these containers at all timal except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° P) and ambient pressure for at least 14 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., 0.5 mg change from previous weighing record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the inheratory atmosphere for a period greater than 2 minutes and a relative hundring above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 108° C (230° P) for 3 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2: it is recommended that a leak-check of the pitot lines (see Method 2. Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rece settings. Determine the stack

gas dry molecular weight, as described in Method 2. Section 3.6: if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with and for the same total length of time as, the particulate sample run.

Select a nozzie size based on the range of velocity heads, such that it is not necessary to change the nozzie size in order to maintain isokinetic sampling rates. During the run, do not change the nozzie size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors. The sampling time at each point shall be the same.

In some cirumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 mi of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 500 g of preweighed silica gei from its constainer to the fourth impinger. More silica gei may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed (ilter in the filter holder. Be sure that the filter is property centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzie using a Viton A O-ring when stack temperatures are less than 260° C (500° F) and an asbestos string gasket when temperatures are higher. See APTD-0578 for details. Other connecting systems using either 318 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzie as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0575) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 tag or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by piusging the nozzle and pulling a 180 mm Hg (15 in. Hg) vacuum.

Note A lower vacuum may be used provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cycone, if applicable) and puilling a 350 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum: alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 350 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.09057 m*min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0578 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve, completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Fo not reverse direction of bypass value; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check as shown below and start over.

When the leak-cheek is completed, first slowly remove the plug from the inlet to the probe, (iller holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica get from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes unecessary, a leak-check shall be conducted immediately before the chaose is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00067 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered:

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Note that when two or more trains are used separate analyses of the front-half and 'il' applicable) impinger catches from each train shall be performed, unless identical norale sizes were used on all trains, in which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2. Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or smother test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditiona, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup ate, remove the probe from the sample train, wipe off the silicone greace, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first implayer or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the fliter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweesers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry Nylon

bristle orush and/or a sharp-edged blade.

Container No. 2. Taking care to see that dust on the outside of the prope or other extender surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzie, probe fitting, probe liner, and front half of the filter holder by washing these components with accome and placing the wash in a glass container. Distilled water may be used instead of acctone when approved by the Administrator and shall be used when specified by the Administrator, in these cases, save a water blank and follow the Administrator directions on analysis. Perform the acctone runses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and russe the inside parts of the Swagelok fitting with actions in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilt. ing and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Lut the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid on transfer-ring liquid wasnes to the container. Follow the acetone runse with a probe brush. Hold the probe in an inclined position, squirt ace tone into the upper end as the prope brush is being pushed with a twisting action through the probe: hold a sample container underneath the lower end of the probe, and ratch any acetone and particulate matter wnich is brushed from the probe. Run the brush through the probe three times of more until no visible particulate matter is carried out with the acetons or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Ringe the brush with acetone, and quantitatively collect these washings in the sample con-tainer. After the brushing, make a final acctone rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushed clean and protected from contamins one.

After ensuring that all joints have ! -n wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acctone. Rinse rach surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laborate ry. Mark the neight of the fluid levcel to determine whether or not leakage occured during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica get without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger, it is not necessary to remove the small amount of dust particles that may adhere to the impunger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a noiation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ±1 mi by using a graduated cylinder or by weighing it to within ±0.5 g by using a balance (If one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless assiysis of the impinger catch is required (see Note. Section 2.1.7).

If a different type of condenser is used, measure the amount of mousture condensed either volum strically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet 'uch as the one shown in Figure 5-3. Handle each sample container as follows:

FIGURE 5-3-AMALYTICAL DATA

Run No Pilter No. Amount II Acetone b Acetone w Aceto le b	quid lost du lank volume lank concen	ring transpo , mi , mi , mi	
	meh blank, r		
P			See Marie
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	Activities we sustained	330 •••	
Proj			
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coresine by develop of water (1 g/A-Q.

Increases, g Wolgree water, mi (1 g/mi) Container No. 1. Leave the contents in the shipping container or transfer the filter and any hoose particulate from the sample container to a tared glass weighing dish. Desicate for 24 hours in a desicuator containing anhydrous calcium suiffate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section. 4.3. the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 4 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 103° C (220° 2°) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105° C (220° P) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticesole amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiceste for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 1. Weigh the spent silica gei (or silica gei plus impunger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumentrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desictate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Note: At the option of the tester, the contents of Container No. 2 as well as the acctone blank container may be evaporated at temperatures higher than ambient. If evarration is done at an elevated temperature, the temperature must be below the boiling rount of the solvent: also, to prevent "humporation process must be closer," the evaporation process must be closer, supervised, and the contents of the caker must be swirled occasionally to mainain an even temperature. Use extreme care, as scetone is highly flammable and has a low flash point.

4.4 Quality Control Procedures. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection. These procedures are ontional for the taster.

4.4.1 Meter Orifice Check. Using the calibration data obtained during the calibration procedure described in Section 5.3, determine the ΔH_0 for the metering system orifice. The ΔH_0 is the orifice pressure differential in units of in. H_0 O that correlates to 0.75 cfm of air at 528°R and 28.92 in. Hg. The ΔH_0 is calculated as follows:

Where:

 $\Delta H = Average$ pressure differential across the orifice meter, in. $H_0 O_{\rm c}$

To = Absolute average dry gas meter temperature, 'R.

P. = Barometric pressure, in. Hg.

0 - Total sampling time, min.

Y=Dry gas meter calibration factor, dimensionless.

V_a = Volume of gas sample as measured by dry gas meter, dcf.

0.0319=(0.0567 !n. Hg/*R) x (0.75 cfm)4

Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the all-pressure differential for 10 minutes. Record the volume rollected, the dry gas meter temperature, and the parometric pressure. Calculate a dry gas meter calibration check value, Y., as follows:

$$Y_{*} = \frac{10}{V_{*}} \left[\frac{0.0319 \ T_{*}}{P_{**}} \right]$$
 w

Eq. 5-10

Where

Y.=Dry gas meter calibration check value, dimensionless.

10-10 minutes of run time.

Compare the Y, value with the dry gas meter calibration factor Y to determine that:

0.97Y < Y, < 1.03Y

If the Y, value is not within this range, the volume metering system should be investigated before beginning the test.

4.4.2 Calibration Critical Orifice. A calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling mesur box, may be used as a quality control check by following the procedure of Section 7.2.

S. Calibration

Maintain a laboratory log of all calibrations.

5.1 Probe Nomie. Prese nomics shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nomic to the nearest o.ozs mm (0.001 in.). Make three separate measurements using different diameters.

measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nousies become nicked, dented, or correded, they shall be reshaped, sharpend, and recalibrated before use. Each nousie shall be permarantly and uniquely identified.

5.2 Pitot Tube. The Type S pitot take assembly shall be calibrated according to the procedure outlined in Section 4 of Mathed

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the precedure outlined in APTD-0578. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump, for these cases

the following leak-check procedure is suggested: make a 10-minute calibration run i 0.0057 m ½min (0.02 cfm); at the end of th run, take the difference of the measure wet test meter and dry gas meter volume, divide the difference by 10, to get the lear rate. The leak rate should not excee 0.00057 m ½min (0.02 cfm).

After each field use, the calibration of th metering system shall be checked by per forming three calibration runs at a single intermediate orifice setting (based on the previous field test). With the vacuum set a the maximum value reached during the test series. To adjust the vacuum, insert a valvibetween the wet test meter and the inlet of the metering system. Calculate the averagivalue of the calibration factor. If the calibration has changed by more than 5 per cent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0876.

Alternative procedures, e.g., using the crifice meter coefficients, maybe used, subject to the appreval of the Administrator.

Note: If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.1.1 Calibration Prior to Use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is socurate to within 1 percent. Refer to Figure 5.5. The wet test meter should have a capacity of 30 liters/rev (1 fts/rev). A spirometer of 400 liters (14 fts) or more capacity, or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other six may be used, provided that the specified accuracies of the procedure are maintained. Run the metering system pump for about 15 minutes with the orifice Ganowster indicating a median reading as expected in field use to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifics manometer settings, pass an exact quantity of gas through the wet test meter and note the gr volume indicated by the dry gas meter. Also note the barometric pressure, and the temperatures of the wet test meter, the inlet of the dry gas meter, and the outlet of the dry gas meter. Select the highest and lower orifice settings to bracket the expected field operation range of the orifice. Use a minimu volume of 0.15 ma (5 cf) at all orifice settings. Record all the data on a form similar to Figure S.S. and colculate Y. the dry gas meter calibration factor, and ArtS, the onfice calibratius factor, at each prifice setting as shown on Figure S.S. Allowable tolerances for individual Y and AHC, values are given in Figure 5.8. Use the average of the Y values in the calculations in Section 4.

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Before calibrating the metering system, it is sungested that a leak-check be conducted. For metering systems having diaphraym pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-clieck procedure is suggested: make a 10-minute calibration run at 0.00057m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divided the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

5.1.2 Calibration After Use. After each filed use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the tost series. To adjust the vacuum, inset a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the dry gas meter calibration factor. If the value has manged by more than 5 percent, recalibrate the meter over the full range of orifice settings, as previously-detailed.

Alternative procedures, e.g., rechecking the orifice meter coefficient may be used, subject to the approval of the Administrator.

- 5.3.3 Acceptable Variation in Calibration. If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after gives the lower value of total sample volume.
- 5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field.

Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Fass this air through the probe at a typical simple flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in ACTO OCCURATE and also he used. Deploy

Outlet temperature. The procedure outlined in APTD-0576 can also be used. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used. Also, probes with outlet vemperature monitoring capabilities do not require calibration.

- 5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dist thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.
- 5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The follow-

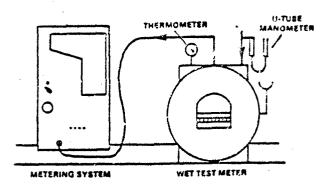
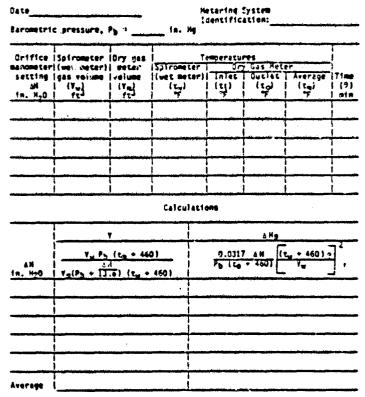


Figure 5.5 Equipment arrangement for metering system culibration.



- Ratio of reading of set test mater to dry test mater; tolerance for individual values :9.02 from average.
- ably Orifice pressure differential that equates to 0.75 ofm of air 0.68°F and 29.92 inches of mercury, in. H₂O; tolerance for individual values ±0.20 from average.

Figure 5.6. Example data sheet for calibration of metering system (English units).

ing procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing atached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurue the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a loak in the meter box: leaks, if present, must be corrected.

5.7 Baronieter. Calibrate against a mercury barometer.

6. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

6.1 Nomenciature

- A. Cross-sectional area of nozzie, m²(ftⁿ).

 B. Water vapor in the gas stream, proportion by volume.
- C.=Acetone blank residue concentration, mg/ng
- c.=Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

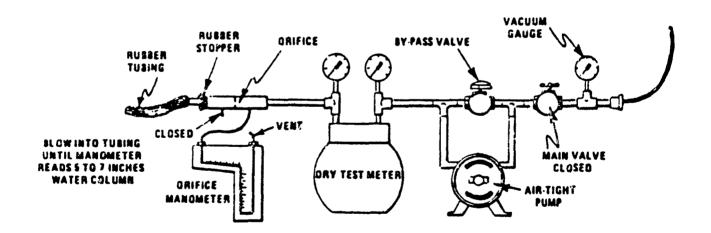
I = Percent of isokinetic sampling.

- L_u=Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.0057 m²/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.
- L=Individual leakage rate observed during the leak check conducted prior to the "1"" component change (1=1, 2, 3....a), m"min (cfm).
- L. Leakage rate observed during the posttest leak check, m4/min (cfm).
- m. Total amount of particulate matter collected, mg.
- M. = Molecular weight of water, 18.0 g/g-mole (18.01b/lb-mole).
- m, = Mass of residue of acteone after evaporation, mg.
- P_{us} = Barometric pressure at the sampling site, mm Hg (in, Hg).

- P.=Absolute stack gas pressure, mm Rg (Hg).
- P. Standard absolute pressure. 760 m Hg (29.92 in. Hg).
- R=Ideal cas constant, 0.06236 mm Hg-r
 'K-g-mole (21.85 in, Hg-ft'/'R-lb-mole
- T. Absolute average dry gas meter temp ature (see Figure 5-2). 'K ('R).
- T, = Absolute average stack gas temperati (see Figure 5-2), 'K ('R). T...=Standard absolute temperature, 293'
- T__=Standard absolute temperature, 293* (528° R).

V. - Volume of acetone blank, mi.

- V_m=Volume of acetone used in wash, mi.
 V_m=Total volume of liquid collected in a pingers and silicated (see Figure 5-mi.
- V. Volume of gas sample as measured dry gas meter, dcm (docf).
- Vocation Volume of gas sample measured in the dry gas meter, corrected to stands, conditions, dscm (dscf).
- Votation Volume of water vapor in the g sample, corrected to standard conc tions, sem (sef).
- n.=Stack gas velocity, calculated by Metho 2. Equation 2-8, using data obtains from Method 5, m/sec (ft/sec).
- W. = Weight of residue in acctone wash, m
 Y=Dry gas meter calibration factor.
- 2H-Average pressure differential acro the orifice meter (see Figure 5-2), m. H₂O (In. H₂O).
- μ = Density of acetone, mg/mi (see label α bottle).



Pigure 8-4. Leak check of mater hou.

== Density of water, 0.3982 g/ml (0.002201 lb/ml).

8-Total sampling time, min.

3, =Sampling time interval, from the beginning of a run until the first component change, min.

8. Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

6.=Sampling time interval, from the final (nth) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 - Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C; 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_{m (sid)} = V_{m} Y \left(\frac{T_{sid}}{T_{m}} \right) \left[\frac{P_{bar} + \frac{\Delta H}{13.8}}{P_{sid}} \right]$$
$$= K_{1} V_{m} Y \frac{P_{bar} + (\Delta H/13.6)}{T_{m}}$$

Equation :-

where:

K. 40.3358 *K/mm Hg for metric units =17.54 *R/m. Hg for English units

Note Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the posters) leak check or leak checks conducted prior to component changes) exceeds L_a. If L_a or , exceeds L_a. Equation 5-1 must be modified as follows:

(a) Case I. Ho component changes made during sampling run. In this case, replace V_n in Equation 5-1 with the expression:

(b) Case II. One or more component changes made during the sampling run. In this case, replace $V_{\rm a}$ in Equation 3-1 by the expression:

$$\begin{bmatrix} V_{\mathbf{q}} - (L_{\mathbf{q}} - L_{\mathbf{q}}) \boldsymbol{\theta}_1 \\ - \sum_{i=2}^{n} (L_{i} - L_{\mathbf{q}}) \boldsymbol{\theta}_i + (L_{i} - L_{\mathbf{q}}) \boldsymbol{\theta}_n \end{bmatrix}$$

and substitute only for those leakage rates $(L_n \text{ or } L_n)$ which exceed L_n .

6.4 Volume of water vapor.

$$V_{e \, (\text{sid})} = V_{1x} \left(\frac{\mu_{e}}{M_{e}} \right) \left(\frac{RT_{\text{sid}}}{P_{\text{sid}}} \right) = K_{1} V_{1x}$$

vhere:

K₁=0.001333 m¹/m₂ for metric units ±0.04707 ft¹/ml for English units.
6.5 Moisture Content.

Equation 5-3

Note in saturated or water displet-laden gas streams, two calculations of the moisture content of the stack gas chall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of S_o snall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1° C (2° F).

6.6 Acetone Blank Concentration.

Equeuon 5-4

6.7 Acetone Wash Blank.

We = C. Veran Equation 5-5

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acctone blank (see Figure 5-3).

Note: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration. $C_{r}=(0.001~g/mg)~(m_{\rm e}/V_{\rm m}~(m_{\rm e}))$ Equation

6.10 Conversion Factors:

Fram	. fo	Anton of
k	m'	0.02432
)/Ħ ⁴		, 15 4 3 .
}/{{*	P/K,	2.205 x 10"
1	ine	0.001

6.11 Isokinetic Varition. 6.11.1 Calculation From Raw Data.

$$I = V_{e} Y$$

$$100 T_{e}(K_{b}V_{te} + (\frac{A}{T_{e}})(P_{te} + \Delta H/13.6))$$

$$608_{ee} P_{e} A_{e}$$

Equation 5-7

where:

K.=0.003454 mm Hg-m³/mi-'K for metric units. =0.002569-in, Hg-lt³/mi-'R for English units.

6.11.2 Calculation From Intermediate

 $I = \frac{T_1 V_{-1643} P_{eve} 100}{T_{eve} v_0 A_2 P_{e} 66 (1 - H_{eve})}$

$$=K_{*}\frac{T_{*}V_{m,\{s,\phi\}}}{P_{*}V_{*}A_{*}\theta\left(1-B_{r,\bullet}\right)}$$

Equation 3-6

where:

K.=4.320 for metric units =0.09450 for English units.

6.12 Acceptable Results. If 90 percent < I < 110 percent, the results are acceptable. If the particulate results are low in companson to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results. Citation 4 in the bibliography section can be used to make acceptability judgments. If I is judged to be unacceptable, reject the particulate results and repeat the test.

6.13 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2. 7. Alternative Procedures

7.1 Dry Gas Meter as a Calibration Standard. A dry gas meter may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.3, provided that it is calibrated initially and recalibrated peri-dically as follows:

7.1.1 Standard Dry Gas Meter Calibration.

T.1.1.1 The dry gas meter to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters, rev (0.1 ft ³/rev). A spironieter (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft ²/rev) and capable of measuring volume to within ±1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meters. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

7.1.1.2 Set up the components as shown in Figure 5.7. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 3 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the dry gas meter should be minimized (no greater than 100 mm H₂O (4 in, H₂O) at a flow rate of 30 liters/min (1 cfm). This can be accomplished by using large diameter tubing connections and straight pipe fittings.

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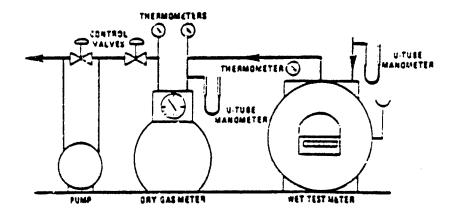


Figure 5.7. Equipment arrangement for dry-gas meter calibration.

7.1.2.3 Collect the data a, shown in the example data sheet (see Figure 5-4). Make and 34 liters/min (0.23 and 1.2 cfm) or over triplicate runs at each of the flow rates and the expected operating range. triplicate runs at each of the flow rates and at no less than five different flow rates. The

1.29

	IATE:										
				TEMPER	ATURES		DRY BAS				
APPROXIMATE	RETEMBRITER (RETEM TEM)	MRY WAS	SPIROMETER		DAY GASA	ETET				1	
FLOW DATE (3)	LV)	H3 (A ^{ct)} AOF nee	(WET METER)	MLET by sp	OUTLET No.	AVERAGE Ed °F	MET(à PRESSURE (àp) In. Hy®	TRAC (0) mts.	FLOW RATE (00 ctm	METER METER CREFTCHENT (Ya)	AVERAGE METER COEFFICIENT (^V o.)
9.€											
1.00											
1.00											
1.29											

Figure 5.8. Example data short for collisation of a standard dry has meter for method 5 sampling equipm, but (Enalish units).

7.1.1.4 Calculate flow rate, Q, for each run using the wet test meter gas volume, $V_{\rm so}$ and the run time, ϑ . Calculate the dry gas meter coefficient, $Y_{\rm so}$, for each run. These calculations are as follows:

$$Y_{as} = \frac{V_{as}}{V_{as}} = \frac{(t_{as} + t_{ass})}{(t_{as} + t_{ass})} = \frac{F_{ass}}{\left(P_{ass} + \frac{\Delta p}{13.6}\right)}$$

Where:

أأو

EC.=0.3858 for international system of units (SI): 17.64 for English units.

V. ... Wet test meter volume, liters (ft ?).
V. ... Dry gas meter volume, liters (ft ?).

twa Average dry gas meter temperature. 'C

t_{me}=273° C for SI units: 460° F for English units.

L. Average wet test meter temperature. 'C ('T').

R. Assembly to pressure men Hg (in Hg).

P....a Barometric pressure, mm Hg (in. Hg). 10=Dry sas meter inlet differential pressure, mm H₂O (in. H₂O).

#=Run time, min.

7.1.1.5 Compare the three Y_m values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runmay be made in order to complete this requirement. In addition, the meter coefficients should be between 0.98 and 1.05. If these specifications cannot be met in three sets of successive triclicate runs, the meter is not suitable as a calibration standard and should not be used as a.cn. If these specifications are met, average the three Y_m values at each flow rate resulting in five average meter coefficients, Y_m.

7.1.1.5 Prepare a curve of meter coefficient. The versus flow rate, Q, for the dry gas meter. This curve shall be used as a refcrence when the meter is used to calibrate other dry gas meters and to determine whether recalibration is required.

7.1.2 Standard Dry Gas Meter Recalibra-

7.1.2.1 Recalibrate the standard dry cas mater against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This requirement is valid provided the standard dry gas meter is kept in a laboratory and, if transported, cared for as any other laboratory instrument. Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

1.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Pollow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates is usgested rates are 14 and 38 liters/min (0.5 and 1.0 cfm)). Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the 1-wo coefficients are within ±1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibration check.

7.2 Critical Orifices As Calibration
Standards. Critical onfices may be used as calibration standards in place of the wet test meter specified in Section 5.3, provided that they are selected, calibrated, and used as follows:

7.2.1 Section of Critical Orifices.
7.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubings which have bern found suitable for use as critical orifices. Other materials and critical orifices. Other materials and critical orifices act as true critical orifices i.e., a critical vacuum can be obtained, as described in Section 7.2.2.3. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and 34 liters/min or the expected operating range. Two of the critical orifices should bracket the expected operating range.

A infillmum of three critical orifices will be needed to calibrate a Method 5 dry gas meter (DGM); the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown below give the following approximate flow rates:

Gaugeron	From rose Oters/ment	Coups/em	Flore rose Suars/many
12/7 8	32 96	14/25	19 54
12/10.2	30 02 i	14/8 1	17.27
13/2.5	25.77	14/78	16.14
12/9 1	2 50	15/3.8	14.16
13/7.5	2.37	15/7.3	11.61
12/10.2	0.67	19/13.2	10 44

7.2.1.2 These needles can be adapted in a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13- by 20-mm size:-e type, into a Ve-mon Stragelok quick cordioct. Insert the needle into indistopper as shown in Figure 5-6.

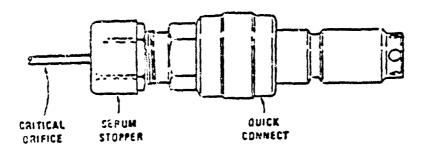


Figure 5-9. Critical orifice adaptation to Method 5 metering system.

7.2.2 Critical Orifice Calibration. The procedure described in this section uses the Method 3 meter box configuration with a DGM as described in Section 2.1.8 to calibrate the critical orifice. Other schemes may be used, subject to the approval of the Administrator.

7.2.2.1 Calibration of Meter Box. The critical orifices must be calibrated in the same configuration as they will be used: i.e., there should be no connections to the inlet of the orifice.

7.2.2.1.1 Scfore calibrating the meter best, leak check the system as follows: Fully open the charse edjust valve, and completely close the by-pass valve. Plug the inlet. Then true on the pump, and determine whether there is exy leakage. The leakage rate shall be sero: i.e., an detectable movement of the DGM distability be seen for 1 minute.

7.2.2.1.2 Check also for Innkages in that portion of the sampling trein between the pump and the orifice meter. See Section 3.8 for the procedure: make any corrections. If necessary. If leakage is detected, check for

cracked gaskets, loose fittings, worn O-ro ga. etc., and make the increasery repairs.

7.2.2.1.3 After desirmining that the meter box is leakless, calibrate the meter box according to the proceeding given in Section 8.3. Make sure that the wet test meter meets the squirements scaled in Section 7.1.1.1. Check the water level in the wat test meter. Assord the DGP calibration factor. Y.

7.2.2. Calibr. tion of Critical Onfices. Set up the apparatus as shown in Figure 5–10. SILLING COOR SIGNATURE.

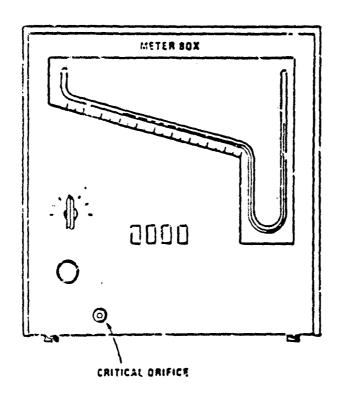


Figure 5-10. Apparatus setup.

72221 Allow a warn-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM. 7.22.12 Link check the system as in Section 7.2.2.1.1. The leakage rate shell be ? 27O.

2223 Before calibrating the critical ortice determine its cuitability and the appropriate operating vacuum as follows: Turn on the pump, fully open the coarse adjust valve, and adjust the by-pass valve to give a vacuum reading corresponding to about haif of atmospheric pressure. Observe the me'er box canics manometer reading. H. Slowly moreone the vacuum reading until a stable rending is obtained on the meter box onfice menometer. Record the critical versum for each onfice.

Orifices that do not reach a critical value

shall not he used.
7.2.2.4 Obtain the basements prousing a berometer as described in Section 2.1.9. Recald the barometric pressure, Part, in mm Hg (in. Hg).

7.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 m. Hg) above the critical vacuum. The ress shall be at least 5 minutes each. The DGM volume readings shall be in increments of 0.00283 m^a 10.1 ft 7 or in increments of complete revolutions of the DGM. As a guarante, the times should not differ by more than 3.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ± 8.5 percent in K'. Record the information listed in Figure 5-11.

7.2228 Calculate K' using Emation & A.

Critical orifice coefficient,

T---- = Absolute ambient temperature, "K ("R). Average the Ke values. The individual Ke values should not differ by more " an ±0.5 percent from the everage.

Sections 7.2.2.2.1 to 7.2.2.2.5. Record the information listed in Figure 5.12 7.2. Using the Critical Orifices as Calibration Standards. 7.2.3.) Record the berometric pressure.

D	20	n No	
Dry gas meter		1	2
Final reading	. m² (ft?)	İ	
initial residing	. m³ ((t³)		
Drillarence, V.	. m³ (ft²)		
Inlet/Cuttet		ĺ	1
temperatures:		.	1
mai	. 'ር ('ዖ)	/	1
Final	. °C ('F)	/	1
Avg	°C (°F)	, 	
Temperature,		1	1
4.		1	1
Time, ()	. mm/sec	/	1
	(1987)		
Onlice men, ring.,	mm (xr.)		.
AH.	H.O.	•	ì

Bar, pressure, P. mrn (in.) Hg.,

Figure 5-11. Data elect for determining K' .cto.. 7.2.3.2 Calibrate the metering system

'ር ('F) .

mm (ic.) Hg.

according to the procedure outlined in 7.2.3.3 Calculate the standard volume air pessed through the DGM and the untical onfices, and calculate the DGM colibration factor. Y, using the equations below:"

V_(sid)=E, V_ P_+(\Delta H/13.8)	Eq. 5-10
V_(stu)=K' P	E4 1-11
Y= Voices	Eq. 5-12

where:

Amount

K' factor

temperature, Pump vacuum.

Average.

through the critical orifice, corrected to standard conditions, dam3 (dacf). K1=0.0856 'K/mm Hg for metric units=17.64 'R/un. Hg for Eschah units.

7.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y. at each of the flow setes the cold not differ by more than #2 percent. i im the average.

7.2.3.5 To determine the mind for recalibrating the critical orthices, compare the DCM Y factors obtained from two edjacent onfices each time a DGM is calibrated; for example, when checking 13/2.5, use onlices 12/10 % and 13/5.3. If any critical civilor yield: A DGM Y factor differing by mor "than 2 percent from the others, recalibrate the critical onlice according to Section 7.2.2.

Par. 100 200		Aun Her			
Dry yes meter	1	. 2			
Final reading mº [[t*	1				
invest reading m* (it*	}	_			
Cittorence, Va 034 (014					
inter, auster					
temperatures:		•			
"C (".")	/	~ <i>j</i>			
Fnel *C (*F)	/	: /			
Temperature.	i				
L	ļ	:			
Time, 0 mm/se	c/	1			
Onfice man, rog., I nm (in	L)				
AH. HO.	. 1	:			
Bar, prosoure, P mm (m	.) Hg				
Ambient "C ("F)					
Pump vacuum mm (in	.) Hg				
)j				
OGM cal. factor, Y	, , , , , , , , , , , , , , , , , , , ,				

_Trein_ID ____

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Proce 5-12. Data short for determining DCM Y factor

1. Bibliography

- 1. Addendum to Specifications for Incinerator Testing 64 Pederal Pacilines, PHS, NGAPC, Dec. 8, 1967.
- A. Martin, Robert M. Construction Details of Liokinetic Source-dampling Equipment, Environmental Protection Agency, Research Triangle Park, N.C. APTD-0581, April 1971.
- 3. Rom. Jerome J. Maintenance. Calibration, and Operation of Iokinetic Source Sampling Equipment. Environmental Protection Agency. Rusearch Triangle Perk. N.C. APTD-0575. March, 1977.
- 4. Smith, W. S., R. T. Shigehara, and W. F. Todd. A method of Interpreting Stack Sampling Data. Paper Presented at the 63d Annual Meeting of the Air Pollution Control Association, St. Louis, Mo. June 14-19, 1970.
- Smith, W. S., et al. Stack Gas Sampling Improved and Simplified With New Equipment. APCA Paper No. 67-119, 1967.
- 6. Specifications for Incinerator Testing at Pederal Pacilities, PHS, NCAPC, 1967.
- 7. Shigehara, R. T. Aujustments in the LPA Nonograph for Different Pitot Tube Coefficients and Dry Molecular Weights. Stack Sampling News 24-11. October, 1974.
- 8. Voltaro, R. P. A Survey of Commercially Available Instrumentation For the Measurement of Low-Range Gas Velocities, U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, N.C. November, 1976 (unpublished paper).
- Annual Book of ATTM Standards, Part 28. Gassous Pueix: Coal and Cober Atmospheric Analysis. American Society for Testing and Materials. Philadelphia, Pa. 1974, pp. 617-623.
- 10. Pelix, L. O., G. I. Clinard, G. E. Lacey, and J. D. McCain. Inertial Cascade Impactor Substrate Media for Plus Gue Sampling. U.S. Environmental Protection Agency. Research Triangle Park, N.C. 27711, Publication No. EPA-606/1-17-066, June 1977, 33 n.
- search Triangle Park, N.C. 27711, Publication No. EPA-606/T-77-000. June 1977, 23 p. 11. Westlin, P. R. and R. T. Shigenara. Procedure for Calibrating and Using Dry Gas Volume Meters as Calibration Standards. Source Evaluation Society Newsletter. #117-30. February 1978.
- 12. Lodge, [.P.,]r., [.B. Pete B.E. Ammone, and G.A. Swenson. The Use of Hypodermic Needlee as Critical Orifices in Air Sampling. J. Air Poliution Control Association. 18:187–201. 1984.

FR Ooc. 87-4551 Filed 3-25-47; 8:45 amil

July 1990 Revision: Final

EPA METHOD 3A

DETERMINATION OF OXYGEN AND CARBON DIOXIDE CONCENTRATIONS IN EMISSIONS FROM STATIONARY SOURCES

Method 3A—Determination of Oxygen and Carbon Dioxise Concentrations in Emissions From Stationary Sources (Instrumental Analyzar Procedure)

1. Applicability and Principle.

1.1 Applicability. This method is applicable to the determination of oxygen (O₂) and carboa dioxide (CO₂) concentrations in emissions from attaining sources only when specified within the regulations.

1.2 Principle. A sample is continuously extracted from the effluent stream: a portion of the sample attenti is conveyed to an instrumental enalyzer(s) for determination of O₂ and CO₃ concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. Range and Sensitivity.

Same as Method 6C. Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O₂ or CO₂ concentration is not less than 20 percent of the span.

- 3. Definitions.
- 3.1 Measurement System. The total equipment required for the determination of the O₅ or CO₅ concentration. The measurement system consists of the same major, subsystems as defined in Method &C. Sections 3.1.1, 3.1.2, and 3.1.2.
- 3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Driff. Calibration Drift, Response Time, and Calibration Gurve. Same as Method 8C. Sections 3.2 through 3.8, and 3.10.
- 3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.
- 4. Measurement System Performance Specifications.
- Same as Method &C. Sections 4.1 through
 - 5. Apparatus and Reagents.
- 5.1 Measurement System. Any measurement system for O₁ or CO₂ that ineers the specifications of this mathod. A schematic of an acceptable measurement system is shown in Figure 0C-1 of Method 6C. The essential components of the measurement system are described below:
- 5.1.1 Sample Probe. A lesk-free probe, of sufficient length to traverse the sample points.
- 5.1.2 Sample Line. Tubing to transport the sample gas from the probe to the moisture removal system. A beated sample line is not required for systems that measure the Co or CO₂ concentration on a dry basis, or transport dry gases.
- 5.1.3 Sample Transport Line, Calibration Value Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6G, Sections 5.1.3 through 5.1.9, and 5.1.11, except that the requirements to use stainless steel, Teflom, and nonreactive glass filters do not apply.
- 5.1.4 Cas Analyzer. An enelyzer to determine continuously the Or or COs concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the enelyzer flow rate

and a device for determining proces sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyser is insensitive to flow measures a were the range encountered during the feet.

5.2 Calibration Gases. The calibration gases for CO₂ analysers shall be CO₂ in N₁ or CO₂ in air. Alternatively, CO₂/SO₂, O₂/SO₂ or O₂/CO₂/SO₂ gas mixtures in N₂ may be used. Three calibration gases, as specified Section 5.3.1 through 5.3.3 of Method 6C, shall be used. For O₂ monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. Measurement System Performance Test Frocedures.

Perform the following procedures before measurement of amissions (Section 7).

6.1 Calibration Concentration
Verification. Follow Section 6.1 of Method
6G. except if calibration gas analysis is
required, use Method 3 and change the
acceptance criteria for agreement among
Method 3 results to 5 percent (or 6.2 percent
by volume, whichever is greater).

- 8.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereefter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.
- 6.3 Measurement System Preparation. Analyzer Calibration Error, and Sampling System Bias Check, Fullow Sections 4.2 through 6.4 of Method 6C.
 - 1. Enlission Test Procedure.
- 7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same entere that are applicable to tests performed using
- Method 3.

 7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling at the same rate as used during the sampling at the same check. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the avalence response time. For each run, use only those measurements obtained after twice the response time of the measurement system has erapsed to determine the average effluent concentration.
- 7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.
- 8 Quality Control Procedures.

The following quality control procedures are recommended when the results of this method are used for an emission rete correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O₂ and CO₂ are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O₂ and CO₂ measurement results.

8.2 If only U₀ is measured using Method 3A, measurements of the sample stream CO₀ concentration should be obtained at the sample by-pess vent discharge using an Orsat or Fyrite analyser, or equivalent. Duplicate samples should be obtained concurrent with alleast one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO₀ values for comparison with the O₂ measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.8 If only CO₂ is measured using Method 3A, concurrent measurements of the eample scream CO₂ concentration should be obtained using an Orsat or Cyntic analyses as described in Section 6.2. For each run, differences greater than 0.5 percent between the Method 3A results and the everage of the duplicate Fyrite analysis should be investigated.

9. Emission Calculation.

For all CO₂ analyzers, and for O₂ analyzers that can be calibrated with zero gas, follow Section 8 of Method 6C, except express all concentrations as percent, rather than ppm.

For O₂ analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A-1.

$$C_{-} = \frac{C_{-} - C_{-}}{C_{-} - C_{-}} (C - C_{-}) + C_{-}$$

Eq. JA-1

where:

C___=Effluent gas concentration, dry basis, percent.

Calibration gas, percent.

Ca = Actual concentration of the low-level calibration was percent.

calibration gas, percent.

C. Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.

C. ~ Average of initial and final system calibration bias check responses for the low-level gas, percent.

C = Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. Bibliography.
Same as bibliography of Method C.

4.2.5 To insure complete absorption of the CDs. Os. or if applicable, CO, make repeated passes through each absorbing solution until two consecutive resultings are the tame. Jeveral passes (three of four) should all make between resultings. (If constant resultings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.2.6 Repeat the analysis until the fol-

lowing criteria are met:

4.2.4.1 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more that (a) 0.3 percent by volume when CO, is greater than 4.0 percent or (b) 0.2 percent by volume when CO, is less than or equal to 4.0 percent. Advange the three acceptable values of percent CO, and report the results to the hearest 0.1 percent.

4.2.3.2 For percent O₀, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when O₀ is less than 15.0 percent or (b) 0.2 percent by volume when O₁ is greater than or equal to 15.0 percent. Average the three acceptable values of percent O₂ and report the results to the nearest 0.1 percent.

4.2.3.3 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more than 0.3 percent. Average the three acceptable values of percent CO and report the results to the nearest 0.1 percent.

4.2.7 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before an after the analysis.

Note: Although in most instances only CO₂ or O₃ is required, it is recommended that both CO₂ and O₃ be measured, and that Section 4.4.1 be used to

validate the analytical data.

4.3 Multi-Point, Integrated Sampling and Analytical Procedure.

4.3.1 Soth the minimum number of sampling points and the sampling point location shall be as specified in Section 3.3.1 of this method. The use of fewer points than specified is subject to the approval of the Administrator.

4.3.2 Follow the procedures outlined in Sections 4.2.2 through 4.2.7, except for the following: Traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4.4 Quality Control Procedures.

4.4.1 Data Validation When Both CO, and O. Are Measured. Although in most instances, only CO, or O. measurement is required, it is recommended that both CO, and O. be measured to provide a check on the quality of the data. The following quality control procedure is suggested.

Note Since the method for validating the CO₂ and O₃ analyses is based on combustion of organic and fossil fuels and dilution of the gas stream with air, this method does not apply to sources that (1) remove CO₄ or O₅ through processes other than combustion. (2) add O₅ (e.g., oxygen enrichment) and N₁ in proportions different from that of air, (3) add CO₅ (e.g., cement or lime kilns), or (4) have no fuel factor, P_m values obtainable (e.g., extremely variable waste mixtures). This method validates the measured proportions of CO₅ and O₇ for the fuel type, but the method does not detect sample ciliution resulting from lesse during or after sample collection. The method is applicable

for samples collected downstream of most line or limestone flue-gas desulfurization units as the CO₂ added or removed from the gas stream is not significant in relation to the total CO₂ concentration. The CO₂ concentrations from other types of scruobers using only water or basic siturty can be significantly affected and would render the P₂ check minimally useful.

4.4.1.1 Calculate a fuel factor, P. using the following equation:

Eq. 3-3

Where:

"O' = Percent O_t by volume (dry basis).

"CO' = Percent CO_t by volume (dry basis).

20.9 = Percent O_t by volume in ambient air.

If CO is present in quantities measurable by this method, adjust the O_t and CO_t values before performing the calculation for F_t as follows:

%O((adj)=%O;-0.5 %CO

Where: %CO-Percent CO by volume (dry

f.4.1.2 Compare the calculated P. factor with the expected P. values. The following table may be used in establishing acceptable ranges for the expected P. if the fuel being burned is known. When fuels are burned in combination, calculate the combined fuel P. and P. factors (as defined in Method 19 section 5.2.3. Then calculate the P. factor as follows:

Eq. 3-4

	Fuel type	F, range
Coat		
	Andreade and Serve	1.016-1.130
	Secretors	1.083-1.230
Ot:		
	Circulate	1.200-1.413
	Permission	1210-1270
Care:		
	Netural	1.890-1.830
	Property	1,434-1,56
	Suterio	1.405-1 551
Wood.		1.000-1.120
Wood:		1,003-1,130

Calculated P. values beyond the acceptable ranges shown in this table should be investigated before accepting the test results. For example, the streng h of the solutions in the gas analyzer and the analyzing technique should be checked by sampling and analyzing a known concentration, such as air; the fuel factor should be reviewed and ventied. An acceptability range of ±12 percent is appropriate for the F. factor of muxed fuels with variable fuel ratios. The level of the emission rate relative to the compliance level should be considered in determining if a retest is appropriate, i.e., if the measured emissions are much lower or much greater than the compliance limit. repetition of the test would not significantly change the compliance status of the source and would be unnecessarily time-consuming and costiv.

5. Leak-Check Procedure for Orial Andi Moving an Orsat analyzer frequesuses it to leak. Therefore, an Orsat lyzer should be throughly leak-checke site before the flue gas sample is introcinto it. The procedure for leak-checking Orsat analyzer is:

5.1.1 Bring the liquid level in eac. pette up to the reference mark on the clary tubing and then close the pipette cock.

5.1.2 Raise the leveling bulb sufficito bring the confining liquid meniscus the graduated portion of the burette then close the manifold stopcock.

5.1.3 Record the meniscus position.

5.1.4 Observe the menicus in the bu and the liquid level in the pipette for a ment over the next 4 minutes.

5.1.5 For the Orsat analyzer to pass leak-check, two conditions must be met.

5.1.5.1 The liquid level in each pix must not fall below the bottom of the c lary tubing during this 4-minute intervs

5.1.5.2 The meniscus in the burette: not change by more than 0.2 mi during 4-minute interval.

5.1.6 If the analyzer fails the leak-c procedure, all rubter connections and cocks should be checked until the cau the leak is identified. Leaking stops must be disassembled, cleaned, and greased. Leaking rubber connections . be replaced. After the analyzer is reas bled, the leak-check procedure must b peated.

6. Calculations

6.1 Nomenciature.

Ma-Dry molecular weight, g/g-mole (II mole).

%EA - Percent excess air.

%CO.=Percent CO. by volume (dry basi %Co.=Percent O. by volume (dry basis). %CO.=Percent CO by volume (dry basis %N.=Percent N. by volume (dry basis). 0.264—Ratio of O. to N. in air, v/v.

0.280 - Molecular weight of N. or CO. d ed by 100.

0.320-Molecular weight of O₂ divided 100. 0.440-Molecular weight of CO₂ divided

6.2 Percent Excess Air. Calculate the cent excess air (if applicable), by subst

ing the appropriate values of percen CO, and N₁ (obtained from Section 4.1 4.2.4) into Equation 3-1.

% EA-

100.

Equatio:

Note: The equation above assumes ambient air is used as the source of Othat the fuel does not contain appreciamounts of N. (as do coke oven or blast nace gases). For those cases when apprible amounts of N. are present (coal, oil natural gas do not contain appreciamounts of N.) or when oxygen enrich is used, alternate methods, subject to proval of the Administrator, are require

6.3 Dry Molecular Weight. Use Equi 3-2 to calculate the dry molecular weig the stack gas

M=0.440(%CO,)+0.320(%O,)+

0.280:%N,+7 Equatio

EPA STATIONARY SOURCE SAMPLING METHODS

Note: The above equation does not consider argon in air (about 0.9 percent, moleculars weight of 37.7). A negative error of about 0.4 percent is introduced. The tester may opt to include argon in the analysis using procedures subject to approval of the Administrator.

7. Bibliography

- 1. Altahuller, A. P. Storage of Gases and Vapors in Plastic Bags. International Journal of Air and Water Pollution, 6.75-81. 1963.
- 2. Conner. William D. and J. S. Nader. Air Sampling with Plastice Hags. Journal of the American Industrial Hygnene Association. 25:291-297, 1964.

 3. Burrell Manual for Gas Analysts, Seventh Addition.
- enth edition. Burrell Corporation, 2223
 Fifth Avenue, Pittsburgh, Pa. 15219, 1951.

 4. Mitchell, W. J. and M. R. Midgett, Field Reliability of the Orsat Analyzer, Journal of Air Pollution Control Association 26:491-
- of Air Pollution Control Association 25:491-495. May 1975.

 3. Shigehara, R. T., R. M. Neulicht, and W. S. Smith. Validating Orast Analysis Data from Fossil Puel-Pired Units. Stack Sampling News. 4(2):21-25. August, 1975.

EPA METHOD 7E

DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

Method 7E-Determination of Nitrocen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)

- 1. Applicability and Principle
- Applicability. This method is applicable to the determination of nitrogen oxides (NO₄) concentrations in emissions from stationary sources only when specified within the regulations.
- 1.2 Principle. A gas simple is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental chemiluminescent analyzer for determination of NO, concentration. Performance specifications and test procedures are provided to ensure reliable data.
 - 2. Range and Sensitivity
 - Same as Method 6C. Sections 2.1 and 2.2.
 - 3. Definitions
- 3.1 Measurement System. The total equipment required for the determination of NO, concentration. The measurement system consists of the following major subsystems:
- 3.1.1 Sample Interface. Gas Analyzer, and Data Recorder, Same as Method 6C, Sections 3.1.1. 3.1.2. and 3.1.3.
- 2.5.2 NO₁ to NO Converter. A device that converts the nitrogen dioxide (NOs) in the sample gas to nitrogen exide (NO).
- 3.2 Span. Calibration Gas. Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, and Response Time. Same as Method &C. Sections 3.2 through 3.8.
- 3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.
- 4. Measurement System Performance Specifications
- Same as Method &C. Sections 4.1 through
 - 5. Apparatus and Reagents
- 5.1 Measurement System. Any measurement system for NO, that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:
- 5.1.1 Sample Probe, Sample Line, Calibration Valve Assembly, Moisture Removai System, Particulate Filter, Sample Pump. Sample Flow Rate Control. Sample Gas Manifold, and Data Recorder. Same as Method 6C. Sections 5.1.1 through 5.1.8, and 5.1.11.
- 5.1.2 NOs to NO Converter. That portion of the system that converts the nitrogen dioxide (NO₂) in the sample gas to nitrogen oxide (NO). An NOs to NO converter is not necessary if data are presented to

, [

- demonstrate that the NOs portion of the exhaust gas is less than 5 percent of the total NO, concentration.
- 5.1.3 NO, Analyser. An ensigner based on the principles of chemiluminescence, to determine continuously the NO. concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.
- 5.2 NO_s Calibration Gases. The calibration gases for the NO_s analyzer shall be NO in N_s. Three calibration gases, as specified in Sections 5.3.1 through 5.3.3. of Method 6C. shall be used. Ambient air may be used for the zero gas.
- 8. Measurement System Performance Test Procedures

Perform the following procedures before measurement of emissions (Section 7).

- 5.1 Calibration Gas Concentration Verification. Follow Section 6.1 of Method OC. except if calibration ges analysis is required, use Method 7, and change all \$ percent performance values to 10 percent (or 10 ppm, whichever is greater).
- 8.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter. recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.
- 8.3 Measurement System Preparation. Analyzer Calibration Error, and Sample System Bias Check. Follow Sections 6.2 through 6.4 of Method 8C.
- 6.4 NO, to NO Conversion Efficiency. Unless data are presented to demonstrate that the NOs concentration within the sample stream is not greater than 5 percent of the NO, concentration, conduct an NO, to NO conversion efficiency test in accordance with Section 5.8 of Method 20.
- 7. Emission Test Procedure
- 7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.

7.2 Sample Collection, Position the sampling probe at the first measurement point, and begin sampling at the same rate a used during the system calibration irift test Maintein constant rate sampling (i.e., =10 percent) during the entire run. The sampling time per run shall be the same as the total time required to perform a run using Mathod 7, plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed, to determine the average effluent concentration 7.3 Zero and Calibration Drift Test, Follow

Section 7.4 of Method 6C.

8. Emission Calculation Follow Section 8 of Method &C. 9. Bibliography

Same as bibliography of Method 6C.

APPENDIX C DESCRIPTION OF CEM SYSTEM

C.ú DESCRIPTION OF CONTINUOUS EMISSION MONITORING SAMPLING SYSTEM

The CEM system used for gaseous pollutant monitoring by EPA Methods 3A, 7E, 10, and 25A is shown in Figure C-1. The sample gas handling system is shown in Figure C-2.

- C.1 Sampling system. Exhaust gas is drawn from the duct or stack through a heated stainless steel (S.S.) probe that is inserted into the duct or stack through one of the test ports. A S.S. valve is located at the probe exit to permit introduction of certified zero and calibration span gases. A heated teflon line is used to transport the sample or zero/calibration gases to the Continuous Emission Monitoring (CEM) trailer. Temperatures are monitored at the exit of each section of line to ensure temperatures are above the sample dew point. Once inside the CEM trailer, the sample line enters a heated junction box where the sample is split into three fractions, and each fraction is directed to one of the following:
 - (a) Charleton Model SC-14 Sample Conditioner.
 - (b) Thermo Electron Model 900 Sample Conditioner.
 - (c) Direct Connection to Total Hydrocarbon Analyzers.

The Charleton Model SC-14 unit is an extractive sample conditioner that removes particulates and moisture from the sample gas. The extracted sample gas is passed through a sintered stainless bypass filter, which removes particulates down to 1 micron or less by an internal filtration technique. The filter is maintained at a temperature above the dew point of the sample gases.

The clean, filtered sample is then introduced to a permeation cayer where moisture is removed without condensation or dilution to achieve a sample dew point well below that of the ambient temperature. The clean, dried sample is then directed to the carbon monoxide (CO), carbon dioxide (CC₂), exygen (O₂), and nitrous oxides (NO_x) analyzers using a teflon-headed sample \mathfrak{p} —np.

The dilution ratio of the Thermo Electron Model 900 sample conditioner is a function of sample/dilution air pressure and capillary tube size. Once set, the dilution ratio is a constant. Sample concentrations are determined by multiplying the analyzer output times the dilution ratio. Nominal dilution ratio for the Thermo Electron Model 900 is 10 to 1.

In the J.U.M. Engineer VE-7 Total Hydrocarbon Analyzer, a S.S. sample filter and detector are contained in a temperature controlled oven. This permits the direct analysis of total hydrocarbons on a wet basis without condensation or loss of sample.

- C.2 <u>CEM system calibration procedures.</u> Calibrations are conducted on a daily basis. The following procedures are performed each day of testing:
 - (a) Analyzer calibration error (pretest).
 - (b) Sampling system bias check (pretest).
 - (c) Sampling system bias neck (post-test).

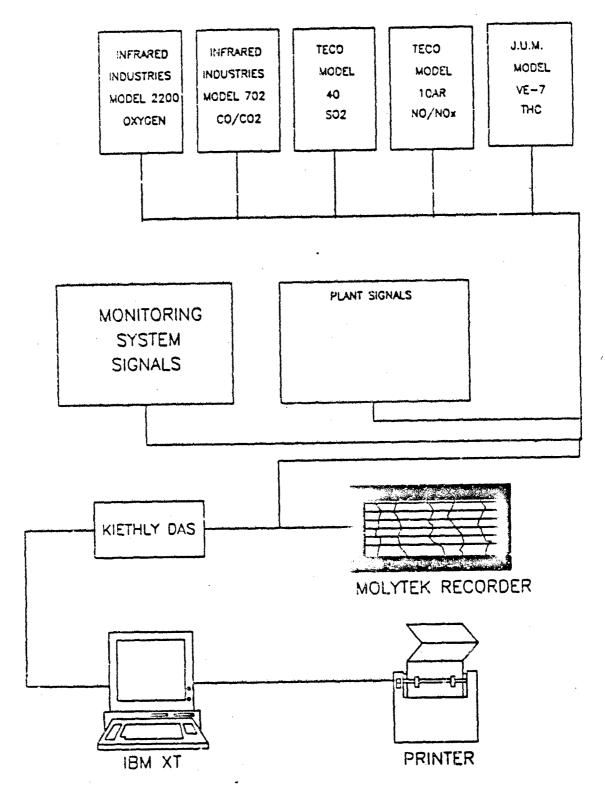


FIGURE C-1. CEM System

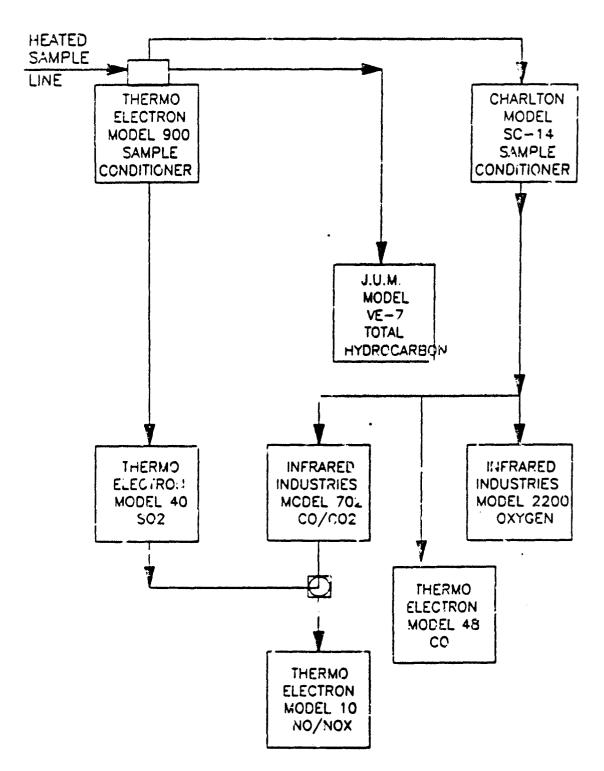


FIGURE C-2. CEM Sample Gas Flow Fath

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Calibrations used cylinder gas standards prepared according to EFA Protocol 1, where available. All other calibration gases are traceable to National Bureau of Standards (NBS) standards.

C.3 <u>CEM system data dollection</u>. Signals from the CEM sampling system are recorded on two devices. Data are available in hard copy from a Molytek strip chart recorder/data logger. In addition, data are recorded in 10-second increments using the Kiethly DAS/IBM PC-XT acquisition system. Data are summarized as one minute averages and are available ensite using the PC-XT system.

APPENDIX D RAW OPERATIONAL DATA SHEETS

Appendix D presents raw operational data collected from process equipment and test items. For each test run, four types of data sharts are enclosed.

The first data sheet (Data Sheet 1) provides information on the physical characteristics of test items evaluated in each test run. The following information is provided:

- Equipment type.
- Contaminants evaluated.
- Dimensions of test item.
- Initial weight of test item.
- Final weight of test item.
- Type of sample collected (rinsate, wipe or solid).
- An indication of type of contaminant spiked to test item (TNT or ammonium picrate).
- Initial and final contaminant concentration (since these items were not known at the time of testing, these columns are generally left blank).
- Thermocouple number.
- Observations (pre- and post-test).

A schematic of the rail cart is included; locations of each type of test item are provided. The following abbreviations are applicable:

- PB Pewder Box.
- SHR Steam Heated Riser.
- SSR Shell Support Rack.
- SHV Steam Heated Discharge Valve.
- CP Clay Pipe.
- SM Ship Mine.
- SP Steel Pipe.
- AP Aluminum Pize.
- denotes test items designated for post-lest sampling and analysis.
- denotes test items designated as spares; items were sampled for analysis only in the event of field or laboratory contamination.
- 0 -F -Diameter.
- Flush.
- R Rinsate. W Wipe.
- S Side (thermocouple location).
- Inside (thermocouple location).

For the first few test runs, the procedures used to record data were still being developed; therefore, some of the information provided on the data sheets is not complete (i.e., contaminants evaluated, sample type, initial/final contaminant concentration, and thermocouple number).

The second data sheet (Data Sheet 2) provides information collected from the following process equipment items:

- Main Control Panel
 - Air preheater inlet damper position (H1C-201)
 - Air preheater inlet air flow (PI-202)
 - Air preheater exit gas temperature (TIC-304)
 - Afterburner inlet air temperature (TI-224)
 - Building (Flash Chamber) Pressure (PIC-201)
 - Afterburner exit gas temperature (TIC-324)
- Air Preheater
 - Gas Pressure (PI-303)
 - Burner Pressure (PI-310)
- Afterburner
 - Gas Pressure (PI-323)
 - Burner Pressure (PI-330)
- Propage Gas Supply Tank
 - Tank Capacity Remaining
 - Tank Temperature
 - Line Pressure
 - Line Temperature

The following discharge emissions were monitored by the Continuous Emissions Monitor (CEM) System and recorded by WESTON personnel:

- Air Preheater Discharge
 - Total Hydrocarbous (THC)
- Flash Chamber Discharge
 - Total Hydrocarbons (THC)
- Afterburner Discharge
 - Total Hydrocarbons (THC)
 - Carbon Dioxide (CO)
 - Carbon Monoxide (CO₂)
 - Oxygen (On)
 - Nitrous Oxides (NO_x)

The following key o breviations is applicable:

PSIG = Pounds per Square Inch Gauge.

PPM/V = Parts Per Million based on Volume.

• % = Percentage.

The following information was monitored and recorded by WESTON personnel:

Dry bulb temperature of ambient air.

Wet bulb temperature of ambient air.

• Moisture content of ambient air (as determined using a psychrometric chart).

The collection times correspond to real time beginning with 0000 hrs and running through 2300 hrs. A separate data sheet is included for each operational day.

Monitoring data were collected and recorded every hour beginning with the firing of the afterburner and continuing until the flash chamber reached the steady state target temperature. After reaching steady state temperature, personnel were not required to be present on the test site. The team left the site and the system operated automatically. During unmanned operation, no data were recorded (except for data recorded during "spot" checks and CEM system data). Data gaps, therefore, exist in the data sheets.

WESTON personnel recorded notes regarding the operation of the system along the sides of the data sheets. These notes usually reflect times when the system reached steady state, and cases where the system shut down, the air preheater started, etc.

The third data sheet (Data Sheet 3) provides temperatures monitored by thermocouples placed on test items within and various locations in the flash chamber. Collection times correspond to real time beginning with 0030 hours and continuing to 2330 hours. Each thermocouple was tagged with an identification number. The thermocouple number is provided across the top of the data sheet (numbers 1 through 20). The test item and flash chamber location monitored are listed below the thermocouple number (i.e., thermocouple 1 monitored the temperature of the diffuser support, etc.). The location of the thermocouple on the test items is provided and is listed as an (I) for internal surfaces or (S or E) for side and external surface areas.

Following the raw data sheets are computer-generated summary sheets (Data Sheet 4). Two data summary sheets are provided for each test. The first sheet contains data collected from the process equipment; the second sheet contains the temperatures collected from the test items and flash chamber. The elapsed time is provided and represents the total number of hours data were collected during a test period. At the end of each summary sheet are values for the mean, maximum, and minimum of the data over the following three time periods: (1) steady state operation, (2) heatup and steady state operation, and (3) total test operation. The averages generated by the computer were used to generate summary tables in Section 8 of the report.

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TEST RUN 2 400°F/24 HOURS DATA SHEET 1
PAGE _ OF _

Test Run T 2 As 2 As 3

Test Date 7 - 18-97

Test Date 7 - 18-97

Hearty Rate 50/4s

Flash Chartest Temperature 400°F

Flash Chartest Indian

30.50 = 2

					*					34.55		
Equipment Type	Conteminant(s)	Okmenskone kryd Vd. Fina VM L H W (Res) (Res)	(Re.)	First W. (Es.)	Parmy P	Sample Type	Equipment Spiker	Miss Contaminant Concentration	Final Contaminant Concentration	Phermocouple 8	Observations Pre-Test Pos	Attons Post-Test
, 981	TMT	WX 67.91	18	5	7	~	TXT			17.5		
, PB3	C. S. S. S. S.		9	9	u	2	_					
1 SHR 1			13	11	١	~				157		
SHRA	"	1. 6 x A.L	13	7.2	١	~				-		
8.55R-1	4 x plosive	X 440 x 9	58	80	3	3						
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TEST RUN 5 500°F/24 HOURS

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FAGE / OF Dete 7/25/89 TON PAN TEST T-S

Test Duratum 24 hes

Hoat Up Rate

Flash Chamber Tempershare		J. 025	Flash Chamber Inter	mber Interlor								
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DATA SHEET 1 FAGE 2- OF 2

Bowler Box *1 - No Lip on Tot of Box. Lis boes not close #11 The way.

Powder Boa 2 - Rounded lip, Lackus in Diameter Than 78.1

STEAM HEATEN RISET#1- GOOD SHOPE, BOTH HANDLES IN TAKT.
SITH #2 - ORANGE PRINT ON SIDE BRISES. GOOD SHAPE.

Shell support RARE . 1 - larger in size. Leveral Asternal areas on Lotton of Rack

558+2 - Amuller in first then 558%. Monimis Botton Staining

Steel PIPE - 6 St. in langth. Black Colon, Recolumn in West Chart, PA.

- LANGO AMT OF DIRT CLY Mis . From one Backer - 5" x 11 12"

Ship HINE - GRIZN IN COLA. Some as all other ship Agries

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DATA SHEET 2
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Chamber
Discharge
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10 DATA SHEET 2 PAGE 2 OF

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DATA SHEET 2 PAGE 3 OF 5

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APPERBLUME RE-LIT AT 910 AM AFREN SWITCHUS IGNITIES

DATA SHEET 2
PAGE 4 OF 5

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DATA SHEET 3 Page 1 of 4 3.11.5 707 27. 3.1,84

Shall Support Rack - SSR - SP Riser - SHR Boxes - PB - SS-S. · AP Valve - SDV Clay Pipe Ship Mina Steel Pipe Aluminum Motor with Discharge Powder Reducer Houled Slearn Healed Steam Key: Pipe Gear 3 0.0 27 ** V. 7 77 33 ,Ç, 23 24 22 7 13 3 1/55 164 242 224 . H. ند (pt 11,54 15 धरमेट वर्ष देव महा महिक्त का फिर्जार मा पष्ट हैंड पिछ पर पर 25528 50 513 100 157 54 314 140 15745 HAY SANKA 126 1171 16.1 16.9 7.23/524 450 HTH483 146 2 0 192 (17 (28) 17.1 2.5 1-13/17/23-K-ASYLNER 3 4) 13.3 71.7 14 16 448 440 3 17 5:7 ×. £. ž 17 45 370 16/12 CM ... 315 115 (44) Ni 1,1 1,4,5 :3 103 27.52 405 Yr 41.5:11 150 224 1584 178 44. 437 27. 824 YE súc. 279 7.7 74 12.5 Ē Supplied In 12 Cet 25th 7.0 53. Rabatasta Isalan Inda Malaka Indhulan ويند LEATERS! رج رت 378 M Junius 12 H N.C. OT 13% 757 3.13 01/4 131 157 451/12 = 747 121 77 30 513 ŝ 13/ 3 (11) o) 27.6 3 442 42 33 <u>३</u> ३ À 16.) 4 may Ξ 151 <u>.;</u> 200 3.73 500 1,65 129,424 (03, Ze) 70120 1 天 بردون الارواد -ာ 35.5 5.)1 151 <u>ار</u> ا 35 35. 37. Tright. 42.1 2015/4 3 1-1-33. 3 بمبر -<u>ئ</u> X <u>;</u> 57 7 Land also 12 17.71 320 333 7.7 <u>``</u> /8/ M 553 ジャング 17 CF 5 SYCONT. G -5.3 7.4 3.55 2.5 157 22 1 3 7 3 11. 133 ij 5 35 流 12. OBSO OFO YEST, R Egulp. * 0130 0530 900 0430 0530 SE30 6730 0830 1030 1:30 1230 1330 1430 1530 1730 1630 1830 1930 2030 2130 2230 2330 177 857c 35

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July 1990 Revision: Final

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8/3/89

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After Burner 1941 mm 12,005 Pm 8/3/89

DATA SHEET 3

Shell Support Rack - SSR Powder Boxes - PB Riser - SHR -AP Clay Pipe Ship Mine Aluminum Pipe Steel Pipe Heated Steam 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 26 29 50 Key: ž 9×100 K 36/19 13/12/12/103/106/15 THE MY 7 9 J 103 Fr. 49 Kg 1 2 3 4 5 6 7 8 יייני יייני יייני 19 13 my 12 1/2 -31 ьв Equip. 1230 (0930 1130 1330 3 8 0220 0830 0030 0130 0230 0330 85

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Clay Pipa - CP Shell Support Rack - SSR Powder Boxes - FB Riser - Sign .AP Valve - SDV ż Abmirum Pipe Moter with Gear Fieducer Ship Mine Steel Pips Discharge Steam Healed **Hoaled** Steam Key: 22 23 24 25 26 27 23 23 30 9 10 11 12 13 14 15 16 17 18 19 20 21 155 135 LPS 3 26 30, 23, 20, 00, 152 1 CA 64 44 14 14 15 15 150 30, 20 125 90 KKK 55190 BY BY BY BY BY BY HOLY BY WELVELY BY LIE KE य राष्ट्री १५ १ १० थि । एको उस्तो उस्तो उस्तो पर्का पर्का संस्था स्था स्था स्था स्था स्था स्था । LYU WO UYUGGE LY 100 (45 VS क्रांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा क्षांत्रमा 410 Ap the trail by the sai व्यक्तिस्थ वान्ष्र्रक्षीयम् वित्र वित्र वित्र रिक्टी स्वत्र किन क्षत्र क्षत्र वित्र वित्र वित्र वित्र वित्र वि DATA SHEET 3 383 (£) 15 55 90 73 78 78 78 78 45 46 45 45 48 48 165 165 165 165 266 355 355 401 AP 151 152 H52 H5 L65 45 45 45 185 90 15 15 150 96 134 136 136 136 136 146 176 136 176 146 अग्र पत्र अभ्य त्राम्य मार्थ पर 10 136 136 136 136 136 146 146 156 • (45) \$ ANG 89 T8 400 / SCHW mo sur 2 3 4 5 6 7 15 16 15 10 DS 70 10 36 40 25 30 æ 18 St æ S 15 15 KS K X 190 18 Polis 906 × lo l 8 Equip. 36 رزر OS30 [[] 1030 4 0430 31 1530 1 €), oceo 1), 0000 1130 46 1230 ([] 1330 1 1% 1430 4 17 octo 0730 () 1930 5030 0530 0330 883 0130 <u>3</u> **473** 583 2130

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+ Insulation was placed around the chamber door custon the chamber sometive

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DATA SHEET 4
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DATA SHEET 4
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APPENDIX E HOURLY AVERAGES FOR CEM SYSTEM DATA

Appendix E provides hourly averages of data collected by the continuous emissions monitoring (CEM) system. The following information is provided:

- Afterburner Outlet
 - Oxygen (O₂) concentration
 - Carbon Monoxide (CO) concentration

 - Nitrous Oxides (NO_x) concentration Total Hydrocarbons (THC) concentration
 - Carbon Dioxide (CO₂) concentration
- Flash Chember Inlet
 - Total Hydrocarbons (THC)
- Fiash Chamber Outlet
 - Total Hydrocarbons (THC)

Two hydrocarbon analyzers were used to monitor total hydrocarbons: one analyzer continuously monitored emissions from the afterburner outlet; the other analyzer intermittently menitored emissions from the flash chamber inlet and outlet on a time sharing basis.

Several data gaps exist for various time periods in the CEM data presented in this Appendix. These data gaps are a result of power failures (usually from lightning events in the Hawthorne area) to the data logger system used to continuously record instrument readings. The data for these time periods were, however, recorded on a strip chart recorder. A review of the strip chart printout indicated that the data for these time periods are consistent with those presented herein.

July 1990 Revision: Final

TEST RUN 2 400°F/24 AOURS

1 22

HAWTHORNS ARRY AMMUNITION PLANT HAWTHURNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Bats: 07/25/69 Test #:

Test		AÉ	Aiterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Gutlet
Tine	02 (8)	(mdd) OO	NO (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
00:11-00:59	11.2	5.4	50.8	<0.1	6.9	1 02	7.1
01:00-01:59	11.2	5.7	49.3	<0.1			7.6
02:00-02:59	11.2	2.6	1.67	1 0>			7,7
03:00-03:59	11.2	5.7	50.4	* · · · · · · · · · · · · · · · · · · ·		# · · · · · · · · · · · · · · · · · · ·	· ·
04:00-04:59	11.2	9.6	51.2	<0.1	-	 	
05:00-05:59	11.2	5.4	51.4	×0.1		· · · · · · · · · · · · · · · · · · ·	0.7
06:00-06:59	11.2		51.2	<0.1		· · · · · · · · · · · · · · · · · · ·) r
0	11.3	0.9	51.8	<0.1 0.1) c
08:00-08:40	11.3	8.9	52.7	* 0 ×			0.7 2.7C
)	:	•	n

HAWTHORNE ARMY AMMUNITION PLANT FAWITHORNE, NEVADA

SUMMARY OF CCATINUOUS EMISSIONS KONIYORING DATA - HOURLY AVERAGES

Test Date: 07/26/89 Test #:

			٠			Flash	Flash
Test		Aţ	Afterburner Outlet	utlet		Chamber Inlet	Chamber Outlet
Time	02 (1)	CO (ppu)	NO _x (ppm)	THC (ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)
15:37-15:59	12.3	6.5	72.6	1.0	5.4	1.0	2.1
6:00-16:59	12.0	9 .9	74.0	9.0	2	. F.	2.3
7:00-17:59	12.2	6.4	9.69	0.5	50	1.0	2.3
8:00-18:59	12.2	6.2	0.99	0.1	5.4	9.0	2.3
9:00-19:59	12.3	5.9	63.7	<0.1	4.0	6,0	1.7
0:00-20:59	12.4	5.5	64.7	<0.1		9.0	99
1:00-21:59	12.5	5.6	63.8	<0.1	. e.	0.7	S (-
2:00-22:59	12.6	5.8	9.09	<0.1	2.5	· (1)	1.7
3:00-23:59	12.7	6.0	9.69	<0.1	5.1	0.7	1.4

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 07/27/89 Test #:

				Flash Tash	r] seh
fte	Afterburner Outlet	tlet		Chamber Inlet	Chamber Outlet
Z	NO _x (ppm)	THC (ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)
1	58.8	<0.1	5.1	9.0	1.5
	57.0	<0.1	5.1	9.0	7
	55.6	<0.1	0.0		
	54.2	<0.1	6.4	0.0	1.7
	55.7	6.1	8.	0.7	
	54.9	<0.1	₩.	. O	
	54.3	<0.1	8.4	. O	
	53.3	<0.1	4.7	0.0	7
	52.5	0.5	4.6	8.0	2.1
(n	2.6	0.3	4.6	. O	200
S	2.4	9.0	4.5	0.4	2.6
S	3.1	₹.0	4.5	8.0	5.7
67	3.8	0.3	4.5	9.0	2.5
W1	13.7	0.5	4.4	8.0	2.6
M	4.3	0.3	4.4	0.7	2.4
S	4.0	0.5	ı,	in, o	2.6
S	3.7	0.1	4.5) eri) (m) () ()
ហ	5.5	0.1	4.8	æ.0	2.2
S	5.1	<0.1	8.	6.0	2.0
U 7	2.5	<0.1	4.6	9.0	2.0
47	1.7	<0·1	4.7	7.0) cs
7	19.1	<0.1	5.7	7.0) t
	51.9	<0.1		• • • • • • • • • • • • • • • • • • •) v
	51.4	<0.1	7.7	9.0	4.4

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUHMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURT AVERAGES

Test Date: 07/28/89 Test #:

Test		Af	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outlet
Time	02 (1)	(mdd) 00	(mdd) x _{ON}	THC (ppm)	(1) (0)	THC (ppm)	THC (ppm)
0:00-00:0	13.4	7.6	49.4	<0.1	4.4	0.5	1.6
:00-01:5	13.4	7.7	48.8	<0.1	7.7	. O	1.7
2:00-02:5	13.4	7.6	48.7	<0.1	7.7	9.0	· • ·
3:00-03:5	13.4	7.4	49.3	<0.1	+.+	4.0	5.1
4:00-04:5	13.5	7.6	50.0	*0.1	+.+	9.0	
5:00-00:5	13.5	7.7	50.2	<0.1	7.7	4.0	1.2
0-06:5	13.5	7.5	49.8	<0.1	7.7	0.2	1.2
7:00-07:4	13.5	•	50.3	<0.1	4.4	6.0	1.2
8:51-08:5	•	9.9	0.3	5.5	0.1	<0.1	10
9:00-00:6	•	•	0.3	1.6	<0.1)
0:00-10:5	19.6	6.7	0.3	1.3	<0.1	0.7	0.6
00-11:5	•	•	0.5	1.3	<0·1	- end 	2.5
:00-12:5	٠	•	0.3	1.2	<0.1		2.4
Š	•	•	0.3	1.2	*0 · 1	0.7	2.8
100-14:5	•	•	0.5	1.3	<0.1	end end	2.4
100-15:5	•	•	0.5	1.3	<0.1	6.0	2.4
100-1615	•	6.4	0.3	1.2	<0.1	7.0	2.2
7:00-17:5	•		0.3	1.5	<0.1	8.0	2.2
100-18:5	•		0.3	17.0	<0.1	9.0	5,10
9:00-19:5	•	7	3.2	1.7	6.0	6,0	2.10
0:00-20:5	•	~	8.3		1.2	5.0	
1:00-21:5	٠	7	9.3	1.0		G C	·
00-2	18.0	22.9	0.6	-) C) () r
3:00-23:5		5	6.8	1.0	1.3	9.0	1.6

TEST RUN 3 500°F/36 HOURS

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 07/19/89 Test #:

Chanber Outlet THC (ppm) Flash 8.4 3.5 2.1 2.7 <0.1 <0.1 <0.1 <0.1 <0.1 **60. c**0.1 **60.1** Chamber Inlet THC (ppm) Flash 0.0 0.2 0.2 1.0 00000 0000 0000 0000 0000 0.9 **.0**× **60.1** (1) 1.3 5.7 5.7 200 THC (ppm) , 0° **60.** <u>^0</u> **60.**1 **60.1 60.** 9.0 30° .. 0 • Afterburner Outlet NO_x (ppm) 67.8 75.8 98.5 78.1 78.6 56.4 12.0 50.4 60.6 58.4 58.4 57.9 CO (ppm) 12.5 12.5 12.5 13.0 13.0 13.0 13.0 Э. С 11.4 11.3 02:00-02:59 06:00-06:59 00:00-00:28 01:00-01:59 04:00-04:59 05:00-00:59 08:00-08:59 09:00-09:59 10:00-10:59 11:00-11:59 12:00-12:59 3:00-13:59 14:00-14:59 15:00-15:59 17:00-17:59 18:00-18:59 19:00-19:50 16:00-16:59 Time Test

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUHMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test #:

Test		AÉ	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outlet
Time	02 (8)	(mdd) oo	NO _X (ppm)	(ppm) THC (ppm)	CO ₂ (8)	THC (ppm)	THC (pp.m)
20:49-20:59	17.5	24.7	11.6	1.2	1.6	9.7	6.1
21:00-21:59	17.6	24.1	11.1	8 .0	1.5	7	. C
22:00-22:59	17.5	24.0	11.0	0.7	.5	6 .0	2.1
23:00-23:59	17.1	24.7	13.2	0.7	39	1.2	1.7

HANTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUHMARY OF CCNTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 67/24/89 Test #:

						Flash	Flash
Test	-	A£	Afterburner Outlet	utlet		Chamber Inlet	Chamber Outlet
Tine	02 (1)	(bpm)	NO _x (ppm)	THC (ppm)	CO ₂ (8)	THC (Ppm)	THC (ppm)
00:00-00:20	16.3	24.4	17.0	4.0	2.3	8 0	0 1
01:00-01:59	15.4	20.3	22.0	<0.1	. ~		
02:00-02:59	14.5	13.5	28.5	· 0 >) o	n •
03:00-03:59	13.4	8.2	38.3) (P (
04:00-04:59	12.2	6.3	51.4	1.0>	7 4	•	0 •
05:00-05:59	11.1	5,5	64.0				* to **
06:00-06:59	10.0	7.5	78.6	1.0			r
07:00-06:59	۲.	*	9 0				C. 1
	•	.,		1.0	7.1	1.0>	1.2

TEST RUN 5 500°F/24 HOURS

SUHHARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Tust Date: 07/29/89 Test #:

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 07/30/89 Test #:

Flash	Chamber Outlet	THC (ppm)	2.1	2.3	7.1	C '	•	1.1
Plash	Chamber Inlet	THC (PPm)	1.0	9.0	ø. 0	o.	9.	₹ .
		(8) 200	5.3	5.4		m,	5.2	5.2
	tlet	THC (ppm)	4.0	0.1	<0.1	*0.1	<0.1	<0.1
	Afterburner Outlet	NO _X (Ppm)	75.3	74.3	72.2	6.99	62.8	59. B
	A£	(mdd) 00	8.8	5.7	5.5	5.4	5.4	5.7
		02 (1)	12.4	12.3	12.2	12.3	12.4	12.5
		Time	18:18-18:59	19:00-19:59	20:00-20:59	21:00-21:59	22:00-22:55	23:00-23:59

SUMMARY OF CONTINUOUS EMISSIONS HOWITORING DATA - HOURLY AVERAGES

Test Date: 07/31/89 Test #:

Test		AÉ	Afterburner Outlet	utlet		Flash Chamber Inlet	Plash Chamber Outlet
Time	02 (8)	(bpm)	(mdd) x Ok	THC (ppm)	202 (1)	THC (ppm)	THC (ppm)
00:00-00:55	12.5	. č	58.5	<0.1	5.2	1.3	1.3
16:32-16:59	16.3	22.6	18.0	1.2	2.5	2.6	
17:00-17:59	15.7	19.7	22.1	0.7	0.6	S	
18:00-18:59	14.9	14.0	29.7	0.5	3.5	6.0	1 m
19:00-19:59	14.0	8.5	41.8	<0.1	7	0	
20:00-20:59	12.7	5.4	59.3	<0.1	2.5	y 0) tr
21:00-21:59	13.5	5.8	58.8	<0.1	4 .5	7.0	7
22:00-22:59	13.5	5.8	57.4	<0.1	4.5	· • • • • • • • • • • • • • • • • • • •	6.
23:00-23:59	13.4	5.7	57.4	<0.1	4.6	4 .0	1 4 7

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/01/29 Test #:

							2 1 2 2
		¥	Afterhurser Outlet	11101	•	Flash Chamber Inlet	riash Chamber Outlet
Test		1	יבי החדיותים	1071			
Time	02 (8)	(pdd) 00	NO _x (ppm)	THC (Ppm)	(1) 200	THC (ppm)	THC (ppm)
00:00-00:29	13.4	5.6	56.1	<0.1	4.6	0.5	1.2
01:5	13.5	5.6	55.5	<0.1	4.5	0.3	1.3
2:00-02:5	13.4	5.6	55.6	<0.1	4.6	9.0	1.1
3:00-0	13.5	5.1	55.0	<0.1	4.5	₹.0	1.2
4:00-04:5	•	6.0	55.4	<0.1	4.5	0.0	1.2
5:00-05:5		•	55.3	<0.1	4.5	₹.0	1.3
6:00-06:5	<u>ښ</u>	٠	55.4	<0.1	4.5	0.3	7.7
9:03-09:5	6	•	2.1	6.3	o.3	6.0	1.9
-10:5	18.3	20.1	~ · · · · · · · · · · · · · · · · · · ·	1.0	1.0	6.7	2.0
1:00-11:5	•	٠	9.5	6.0	1.1	6. 0	2.0
2:00-12:5	æ	-	9.1	1.0	7.7	9.0	2.3
3:00-13:5	œ	,,,,,	o .6	1.2	7.7		2.0
:00-14:5	7.		10.3	1.2	1.3	1.0	1.5
5:00-15:3	۳.	*	9.09	2.6	2.4	2.5	11.9
139-08:5	۳.	•	33.4	7.0	4.5	4. 0	3.1
9:00-00:6	•	7.4	0.7	1.0	4.5	8. 0	1.7
0:00-10:5	۳.		22.5	0.5	4.6	٥.5	1.9
:00-11:3	ď	•	80.8	9.0	7 .0	1.6	
100-12:5		•	53.5	7.0	7.7	1.0	2.2
13:00-13:22	•	•	53.8	0.3	4.4	0.5	3.2

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 38/02/89 Test #:

.

Test		ΛĒ	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outler
Time	02 (8)	(mdd) CO	(mdd) XON	THC (ppm)	CO ₂ (%)	THC (ppm)	THC (ppm)
08:44-08:59	9 61	5.7					
			7.0	1.3	0.7	9.0	1.7
09:00-09:59	13.4	12.9	71.5	4.0	٠	7 -	
10:00-10:59	19.6	2.4	~	. 0>		* ·	9
11:00-11:59	101	u		1.0	7.0	7.01	<0.1
	0	9	7.5	*0. *	0.7	<0.1	<0.1
12:5	19.6	5.7		<0.1	0, 3	1 0>	
13:00-13:59	19.6	2.6	0	- 0			1.0.
14:00-14:59		V			7.0	1.07	
1 1 00	•	, ,	7.	1.0>	7.0	<0.1	<0.1
C1CT_001	•	٠. د.	٠.٥	<0.1	0.5	<0.1	. 0>
:29-16:5	19.6	5.3	0.3	<0.1	0	-	***
17:00-17:59	19.6	5.2	7 0		• •	1.0	1.0
	σ	•		1.0	•	1.0×	<0.1
.00-10.5	•	• <	? (1.0	7.0	40·1	1. 0>
	•	o . c	T. 3	<0·1	0.5	<0.1	
0100-2012	9.61	4.7	۳.	<0.1	0.0		
100-2115	9.61	9.	0 2				1.0
22:00-22:59	9 6 2			1.0	7.0	1.0>	<0.1
200.00	•		7.0	1.0>	0.5	<0·1	<0.1
C1C7_001	19.0	5 .5	6.2	<0.1 0×	0.5	<0.1	\$ 0 J
							•

TEST RUN 8 400°F/36 HOURS

SUMMARY OF CONTINUOUS EMISSIONS HOMITORING DATA - HOURLY AVERAGES

Test Date: 08/03/69

Test #:

Chamber Outset TiiC (ppm) Flash \$ \$ \$ \$ **c**0.1 .. 0. Chamber Inlet THC (ppm) Flash <0.1 <0.1 17.8 <0.1 <0.1 <0.1 <0.1 CO₂ (1) THC (rpua) <0.1 <0.1 <0.1 Afterburner Catlet NO_x (ppm) 0.2 60.1 60.1 19.4 102. 10.1 12.6 15.3 39.1 57.5 CO (ppm) 19.1 26.: 23.(02 (8) 19.1 00:00-00:00 01:00-01:59 02:00-02:59 03:00-03:59 04:00-04:59 05:00-05:59 06:00-06:59 07:00-07:59 09:00-09:59 08:11-08:59 10:00-10:59 11:00-11:59 3:00-13:59 2:00-12:59 17:00-17:59 19:00-19:59 20:00-20:59 14:00-14:59 5:00-15:59 16:00-16:59 8:00-18:59 11:00-21:59 12:00-22:59 13:00-23:59 Tine Test

Control of the Contro

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/04/89
Test #:

1		34		101		Flash	Flash
	1	1 V	Alteiburner Outlet	16161		Chamber Inlet	Chamber Outlet
02 (1)		(mdd) oo	NO _x (ppm)	THC (ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)
١.		4.5	57.0	<0.1	6.8	32.8	26.8
<u>ه</u> .		4.7	57.0	<0.1	6.9	35.7	28.9
•		•	56.9	1.0 >	9.9	38.2	35.6
		5.0	58.0	<0.1	9	62.1	48.2
		5.1	54.0	<0·1	6.2	9.66	। धी । सी
11.3		5.1	53.3	*0.1	0.9	61.2) (T
		8.	59.0	<0.1	6.5	80.00	45.0
		5.1	59.8	<0.1	6.5	588.	77
10.6		s. æ.	72.8	<0.1	6.0	. M	
		•	96.6	7.0	5.6	6.67	10 m
		•	55.6		4.9	9,64	0 00 00 00 00 00 00 00 00 00 00 00 00 0
		0.9	55.8	0.1	9.4	67.4	9.96
		•	55.9	0.1	6.3	46.7	
		•	55.7	0.1	6.3	100 m	
		•	56.7	0.1	. 9	4.	
		•	57.0	0.1	6.3	(A)	3. PE
		•	56.8	<0.1	6.2	(5) (4)) (5)
		•	57.0	<0.1	6.3	44.0	
		•	56.9	<0.1	6.3	45.7	34.7
		•	56.5	<0.1	4.9	47.2	. v
		5.1	54.7	<0.1			1 k
10.7		•	56.0	<0.1	9) c
			56.3	<0.1	2		9 0 0 0
		5.1	56.1	<0.1	7.9	20.0	9 00 00 00 00 00 00 00 00 00 00 00 00 00
							1.11

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 06/05/89 Test #:

						Flash	R Lach	1
Test		A£	Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet	
Tine	02 (8)	(mdd) 00	NO _X (ppm)	THC (ppm)	CO ₂ (%)	THC (ppm)	TMC (ppm)	
00:00-00:28	10.6	5.0	55.7	<0.1	y 9	7.7	4.5.4	- 1
-0115	10.5	5.1	54.8	. 0>		7 4	P () () () () () () () () () (
100-0215		· ·	2 7 3		•	9 (P (٠٠٠ . ١٠٠٠ .	
3.60-02.5			7 ·		٠. د .	2.96	44.3	
			55.6	<0.1	6.5	56.5	44.7	
4:00-04:5	10.5	5.3	56.5	<0.1	9.9	4.50	****	
05:00-05:59	10.5	5.2	56.1	<0.1	9	• a	7	
6:00-06:5	10.4	5.0	56.3	<0>	· ·	ם פרו	7.4	
7:00-07:5	10.5		5, 7, 5	•	•	D (4 ·	
A.00-00-8	•	1 4) (1.0	9	20.3	43.7	
	·	٠	. oc.	<0.1	6.5	48.3	37.5	
2160-0016	30 30	٠	96.1	3.6	5.2	51.5	6 0 4	
0:00-10:5	11.2	•	58.0	<0.1	6.2) u	
11:00-11:59	11.2	S, 79	58.7	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	,	* 6	n. or .	
:00-12:5	11.2		. c	1 0 -> 1 ->	•) · · · ·	30 (
100-1315	11.2	•			7.0	7.75	33.5	
4:00-14:5		•	1.0	1.0	7.0	42.1	33.1	
5.00-18.8	• •	• •	F 0	7.0	· ·	42.2	32.1	
	7 . 1 .	•	. v	<0.1	· •	40.6	32.2	
C: 01-00:	f · 1 1	2.6	58.8	1.0 >	6.1	41.8	32.0	
300-1715	•	•	59.5	<0.1	G	0 07		
18:00-18:59	13.5	•	63.2				7.16	
100-14.5	10	•		7 ·		1.1	2.1	
	1.71	× ·	D. / 0	<0.1	5.3	6.0		
	12.3	5.2	62.1	<0.1	5.2	. o	9	
) · •	

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/06/89 Test #:

				****				1
Test		AÉ	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outlet	
Time	02 (1)	(mdd) OO	NO _x (ppm)	THC (ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)	
09:32-09:59	13.2	6.2	58 9	0 0	9			1
**	11.0	10.1	7.06	7.7		 	23.6	
11:00-11:19	13.1	6.5	000	· ·	c		2.0	
14:30-14:59	13.3	· ·	7 7		.	٠. د د	1.5	
00-15:5	13.3) (c	7 0 7 1 0 7	7.0	æ •	s.•	1.0	
00-16:	13.0) (r	7.05	7.0	29 C	9.0	1.4	
00-17:5	12.2		. C) u		ind :	
	12.2	. 60		7.0	ם ע ע	٠. د د		
9:00-19:		0.7	1 42 1 47 1 47		ם ע	o c		
20:00-20:59	12.3	9.7		7.0	ים מים	7.0	pred :	
21:00-21:59	12.3	7	56.2	• - • -	ים מים	ŗ.		
:00-22:5	12.2	**	() ()	• • • •	n 4	•••	1.0	
23:00-23:59	12.3		55.4		י ע קיי	, e	0.1	
)	•	•		. 7.	

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - KOURLY AVERAGES

Test Date: 08/07/89
Test #:

Test		A£	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outlet
Tine	02 (8)	(prād) 00	NO _x (ppm)	THC (ppm)	CO ₂ (3)	THC (ppm)	THC (ppm)
00:00-00:28	12.3	4.4	53 6	1 07		3 5	
01:00-01:59	12.2	4.3	. A.	7.6	, ,	 	1.2
02:00-02:59	12.1	7	7.10	1.0	٠. د د	9.0	1.3
03:00-03:59	12.2		5. F.C.	7.0	ب ا ۱۵۰	9.0	1.2
04:00-04:59	12.2	7	7.75	7.0	9 (0.5	1.3
05:00-05:59	13.3	7	74.7	7.0		₹.0	1.4
06:00-06:21	19.6	4.2	1.0	7.0	4.7	0.1	1.2
09:51-09:53	11.8	Q:	1.07		٠. و	0.1	1.3
13:58-13:59	11.5	7	. 7	₹. •		<0.1	7.7
14:05-14:22	12.1	· œ	7.09	7.0	7.0	<0.1 -	0.8
) ; }		1.0	7.0	.	1.2

SUMMARY OF CONTINUOUS EMISSIOUS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/08/89 Test #:

Test		AÉ	Afterburner Outlet	ıtlet		Plash Chamber Inlet	Flash Chamber Outlet
Time	02 (8)	(mdd) OO	NO _x (ppm)	THC (ppm)	CO ₂ (8)	THC (ppm)	THC (ppm)
08:37-08:59	19.9	4.4	5.2	5.2	4.0	0.7	2.5
09:00-09:15	17.0	s. 0	2.3	23.4	•••	<0·1	26.5
12:33-12:59	18.1	19.4	5.	1.0	6.0	- 0° - 1° - 1° - 1° - 1° - 1° - 1° - 1°	\$. 0 ×
13:00-13:48	17.5	21.3	8.7	9.0	· ·	<0.1	<0.1

TEST RUN 13 500°F/12 HOURS

SUHMARY OF CONTINUOUS EMISSIONS MOHITORING DATA - HOURLY AVERAGES

Test Date: 08/09/89 Test #:

Flash Chamber Outlet	THC (ppm)	<0.1 <0.1 <0.1 <0.1
Chamber Inlet	THC (ppm)	<0.1 <0.1 <0.1 <0.1
	CO ₂ (1)	8
ıtlet	(ppm) THC (ppm)	<0.1 <0.1 <1.1 <0.1
Afterburner Outlet	NO _x (ppm)	24.4 30.4 45.2 64.2
A	CO (Epm)	18.2 13.5 7.9 4.2
,	02 (8)	14.5 14.1 13.0
Test	Tima	20:26-20:59 21:00-21:59 22:00-22:59 23:00-23:59

SUHMARY OF CONTINUOUS EMISSIOMS HONITORING DATA - COURLY AVERAGE

Test 5ate: 08/10/89 Test #:

-

Test		A£	Afterburner Outlet	ıtlet		Flr.h Chamber Julet	Plash Chamber Outlet
Time	02 (1)	(mdd) 00	NO _x (ppm)	THC (ppm)	(8) 200	THC (ppm)	THC (ppm)
00:00-00:29	10.0	3.8	73.6	<0.1	6.5	, ,	7.9
01:00-01:59	9.3	3.7	52.8	<0.1	7.0	28.4	26.5
02:00-02:59	0.6	3.7	52.9	<0.1	7.2	7.57	- C
03:00-03:59	7.8	3.6	55.5	<0.1	(C)	71.8	4 C C
04:00-64:59	7.2	3.5	62.2	<0.1	6	59.2	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
05:00-05:59	7.1	3.6	5.4	<0.1		46.0	
65:90-00:90	7.3	3.8	65.3	<0.3	· •	4.4	٠, - ١, - ١, -
07:00-07:59	7.7	0.	56.6	<0.1	cs) () ()	A. 4C
08:00-08:59	7.5	4.2	52.5	<0.1	· · ·	47.0	24.2
05:00-00:50	0·8	4.7	49.1	<0.1	5	- M	6 12
10:00-10:59	8.4	4.1	49.0	<0.1	7.6	5.1.5	9 90
11:00-11:40	8.0	6.6	72.8	1.5	6.7	43.9	26.2

SUMMARY OF CONTINUOUS EMISSIONS HOMITORING DATA - HOURLY AVERAGES

Test Date: 08/11/89

						Plash	Flash
Test		AÉ	Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet
Time	02 (8)	CO (ppm)	MO _X (F)	TilC (ppm)	CO ₂ (8)	THC (pp.m)	TAC (ppa)
39:59-11:40	1 .	6.6	101.6	38.9	6.6	<0.1	46.5
10:00-10:55	9.8	18.S	119.6	.1.0	9.9	<0.1	8.8
11:00-11:59	9.1	4.6	142.2	3.0	5.9	11.7	6.0
12:00-12:59	9.6	3.8	101.8	<Ū.1	7.2	6.0	0:
13:00-13:59	9.6	3.9	102.3	<0.1	7.2	1.1	8.1
14:00-14:59	9. 9	3.7	104.1	<0.1	7.2	. .	1.8
:00-15:5	ي. ي.	3.7	105.7	<0.1	7.2	ø.0	9
:00-16:5	9.5	3.7	105.0	40.1	7.2	0.7	.0.1
17:00-17:59	9.5	3.7	105.9	<0.1	7.2	6.0	<u>د</u>
100-18:5	9.5	3.6	107.4	<0.1	7.2	9.0	1.1
100-19:5	4.6	(A)	108.0	<0.1	7.3	6.0	-
0:00-20:5	9.4	2.9	108.4	<0·1	7.3	0.5	
1.00-21:3	9.1	2.e	109.3	<0.1	7.3	0.5	
2:00-22:5	4.6	2.9	107.8	<0.1	7.5	0.5	ਜ
3:00-23:5	4.6	3.E	104.3	<0.1	7.3	(A. 10)) (see

SUMMARY OF CONTINUOUS EMISSIONS MONIFORING DATA " HOUALY AVERAGES

Test Duce: 08/12/89 Test #:

Test		Af	Aftarburner Outlet	it.let		Flash Chamber Inlet	Flash Chamber Outler
Time	0, (8)	CO (ppm)	Ki. (ppm)	THC (DDM)	(3) (3)	THU (DOM!)	and the state of t
	•				7 (.)		(mdd) our
00:00-00:20	9.4	2.9	102.0	<0.1	7 7	30	
01:00-01:59	9.5	2.9	101.8	- 0>			(
02:00-02:59	9.5	2.9	102.2		•	n (1.2
03:00-03:59		· ~	1001	1.0	7.7	7.0	1.1
04.00.00.00	, ,	•	160.0	<0.1	7.2	ر. ب	1.2
60:50-00:50	U.	٦. ٢	101.7	<0.1	7.2	ن ا	
05:00-05:59	9.6	о	161.8	<0.1			7.1
06:00-06:59	9.6	2.8	101.0		• •	•	2 · T
07:00-07:59	7.6		a	7.0	- · ·	* (1.2
08:00-08:59	, 5°	. ~			· ·	 	1.2
10		•	•	7.0	o.,	4.0	1.5
000		• ·	P. 66	. n >	6.9	0.7	1.6
101-00			107.5	7.7	ι. œ		
11:00-11:59	0.01	3.7	98.7	<0.1	0 0		? ·
12:00-12:51	0.01	CC	1 101	ا - ر ر		9 i	
)		1.0		0.5	1.6

TEST RUN 14 400°F/12 HOURS

SUMMARY OF CONTINUOUS EMISSIONS MONITCHING DATA - HOURLY AVERAGES

Test Date: 08/15/89 Test #:

						Flash	Flash	
Test		A£	Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet	
Time	02 (8)	(mdd) 00	NO (ppm)	THC (ppm)	CO ₂ (1)	THC (ppm)	TilC (ppm)	
07:58-07:59	19.3	4.2	<0.1	<0.1	0.3	<0.1	<c.1< th=""><th>ı</th></c.1<>	ı
08:00-08:59	13.1	20.6	106.0	7.8	3.6	6.4	5.2	
09:00-09:59	19.4	5.3	1.4	7.4	₩.0	0.7	2.0	
10:00-10:59	18.5	20.7	5.9	2.6	N.0	10.9	11.6	
11:00-11:59	18.0	21.9	£.3	2.2	1.3	0.5	₩.W	
12:00-12:59	18.1	21.5	8.3	1.7	1.3	0.4	2.3	
13:00-13:59	18.1	21.3	8.1	1.4	E	7 .0	2.0	
14:00-14:59	17.9	22.1	4.6	1.6	7.1	₹.0	1.9	
15:00-15:53	17.3	24.1	12.0	2.4	1.8	₩.0	1.6	
16:00-16:59	16.5	25.6	14.1	2.4	2.3	₹.0	6.1	
17:00-17:59	15.8	22.5	19.4	1.6	2.8	ທຸ0	1.9	
18:00-18:59	15.0	16.8	27.8	6.0	3.4	0	1.8	
100-19:5	13.9	10.0	41.9	0.3	4.2	0. S	1.4	
20:00-20:59	12.7	5.3		<0.1	5.1	₹.0	1.2	
21:00-21:59	11.1	3.4	92 9	<0.1	6.2	4.2	1.1	
22:00-22:59	10.5	3.7	53.5	<0.1	6.5	10.5	10.3	
23:00-23:59	10.2	3.6	57.0	<0.1	9	23.5	23.6	

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/16/89 Test #:

F 7								į
		4		4 %		Flash	Flash	
Test	,	Y	Arcerbirner Outlet	זבופנ		Chamber Inlet	Chamber Outlet	
Time	02 (1)	(mdd) OO	NOx (ppm)	THC (ppm)	co ₂ (1)	THC (ppm)	THC (ppm)	
:00-00:	9.1	3.3	57.4	<0.1	7.6	35.4	26.4	1
1:00-01:5	•	3.4	63.2	<0.1	7.9	38.2	28.7	
2:00-02:5	•	3.4		<0.1	7.8	42.3	29.2	
03:00-03:59	10.8	3.3	62.1	<0.1	6.4	57.7	44.2	
4:00-04:5	0	3.1		1.0 >	6.3	60.0	42.9	
5:00-05:5	0	3.1	69.5	. 9×	9.9	59.9	43.1	
6:00-06:5	10.4	3.3	53.2	<0.1	. 9.9	62.4	44.2	
7:00-07:5		3.2	54.2	<0.1	6.3	51.3	37.1	
8:00-00:5	<u>.</u>	9.6	17.7	6.0	5.4	43.4	35.60	
9:00-00:6	9.5	3.9	63.2	<0.1	7.3	33.5	30.7	
100-1015		•	65.7	<0.1	7.5	31.0	26.2	
100-11:5	•	•	9.79	<0.1	7.5	28.8	23.6	
2:00-12:5	9.4	•	59.1	<0.1	7.4	26.0	21.1	
3:00-13:5		٠	70.7	<0.1	7.3	23.1	1 3 C	
4:00-14:5	11.7	5.1	104.1	<0.1	5.7	7		
:00-15:5	12.1	•	₩.68	<0.1	5.4	· ••••	- C	
:00-16:5	12.4	٠	82.4	<0.1	5.2	0.7	2.0	
7:00-17:5	12.4		76.4	* · 0 >	5.3	6.0	7.6	
8:00-18:5	12.4	0. ¥	73.7	<0.1	5.2	æ. 0	¥	
9:00-19:5	٠.	•	70.4	<0.1	5.1	, o) 1 57	
0:00-20:5			69.3	<0.1	5.1	4.0	• • • • • • • • • • • • • • • • • • •	
1:00-21:5		•	67.7	<0.1		. C	· · ·	
:00-22:5	12.7	٠	67.4	<0.1	5.0	9,0		
3:00-23:5	12.7	3.8	66.8	<0.1	5.0	4.0	4 45°	

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 08/17/89 Test #:

7								
fest		AÉ	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outlet	
Tana	02 (1)	(mdd) oo	(mdd) XON	THC (ppm)	CO ₂ (8)	THC (ppm)	THC (ppm)	
0:00-00:0	12.7	4.0	65.4	<0.1	5.0	1.0	1.4	,
:00-01:5	•		62.8	<0.1	6.4	0.5	1.2	
2:00-02:5	•	4.1	62.2	<0.1	4 .9	9.0	H . H	
•	12.9	3.9	63.1	<0.1	₩.	₹.0	1.2	
4:00-04:5	•	3.9	61.5	<0.1	8.	0.3	1.1	
5:00-05:5	13.0		61.4	<0.1	8. 7	0.5	1.0	
0-06:5	•		61.0	<0.1	9.	0.3	1.1	
7:00-07:5	•	4.2		<0.1	4.7	₹.0	1.0	
8:00-08:5	11.5		78.1	<0.1	8. 8.	₹.0	1.5	
9:00-00:6	;			₽.9	6.1	18.6	10.2	
100-1015			135.3	10.9	4.8	٠.٠	1.6	
1:00-11:5	0	•	0	0.5	8.9	0.5	1.6	
:00-12:5		•	99.3	0.5	6.7	0.1	1.3	
3:00-13:5	⇒	•	100.9	0.3	6.7	₹.0	1.3	
4:00-14:5	_	•	79.6	0.5	5.7	₹.0	7	
5:00-15:5	O	•	0	0.3	6.1	9.0	ال ال	
100-1615	•	•	0	0.5	6.7	0.1	1.5	
7:00-17:5		•	0	0.5	8.9	₹.0	19 · 11	
8:00-18:5	•	•	0	0.1	6.9	₹.0	1.2	
9:00-19:5	•	•	102.7	0.1	6.9	₹.0	1.0	
:00-20:5	•	•	102.2	0.1	6.9	0.5	6.0	
1:00-21:5	0	•	0	0.1	6.9	٥. ٣	1.0	
00-22:5		2.9	9.66	0.1	9.9	0.3	0.1	
3:00-23:5		•	6.66	0.5	8.9	0.5	1.0	

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/13/89 Test #:

Test		Af	Afterburner Outlet	utlet		Flash Chamber Inlet	Flash Chamber Outlet	1
Time	02 (1)	CO (bbm)	NO _x (ppm)	TEC (ppm)	CO ₂ (1)	THC (ppm)	THC (bpm)	
00:00-00:20	10.1	3.2	98.9	0.2	6.8	0.3	1:1	1
01:00-01:59	10.1	3.1	98.0	0.3	6.8	4.0	1.0	
02:00-02:59	10.2	3.1	97.6	0.3	8.9	6.3	6.0	
03:00-03:59	10.2	2.9	96.2	-T.	9	4.0	. c.	
04:00-04:59	10.2	2.8	95.7	0.1	9	· · · · · ·	. o. o	
05:00-05:59	10.2	2.8	94.7	0.1	9	e.0	6.0	
96:00-06:59	10.3	2.9	94.2	0.1	6.7	1.0	6.0	
07:00-07:59	10.3	2.9	93.2	0.1	6.7	0.3	1.0	
08:00-08:59	10.4	3.4	91.5	0.3	9.9	7.7		
09:00-09:59	13.6	10.5	75.2	10.1	2.7	2.4	10.5	
10:00-10:29	9.61	4.6	0.5	1.1	0.5	0.7	1.0	

TEST RUN 15 600°F/12 HOURS

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 08/22/89 Test #:

•

. (**	Afterburger Outlet	16104		Flash	Plash
Test			O TOUTDOTTO	TOTAL		Chamber Inlet	Chamber Outlet
Time	02 (1)	(mdd) ()	HOX (PCM)	(mdd) DHJ,	CO ₂ (1)	THC (ppm)	THC (ppm)
8:49-08:5	19.9	3.5	<0.1	<0.1	0.0	. 02	1 0/
09:00-09:59	15.6	0.8	40.2	4	• -		7.0
:00-10:5		•			4 r	n (ָּטְ פַּי
1:13-11:5	17.9			•	7 .	14.3	1.7.
3.61-00.	7		•	• • • • • • • • • • • • • • • • • • •	7.1		2.4
	0.61	•) 	P	1.3	o. 9	8.
100-1312	17.6	:	9.1	.		œ, C	9
14:00-14:59	17.6	-	0.6	œ.	, ev.		.
:00-15:5	17.3	-	10.3	-	7	•	0.4
16:00-16:59	17.0	٠	12.1	9	-) (o.
:00-17:5	16.3	_	14.2	· ·			
18:00-18:59	15.4	-	19.7) (æ .
100-1915	14.5	'n	31.2) u		
100-2015	13.4	0	6.77) (, o	7 7 -
. 5	12.2	ď		•	•	9	
3.00-00-6		•	7 (1.0	7.0	o.5	1.5
	٠		7.20	1.0×	 •	0.5	1.2
23:00-23:59	9.6	3.0	75.9	<0.1	6.9	18.7	20.4

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HCURLY AVERAGES

Test Date: 08/23/89 Test #:

15

						Flash	Lash
Test.		A1	Afterburner Outlet	utlet		Chamber Inlec	Clamber Outlet
	(8) 20	(mdd) 00	NO _x (ppm)	THC (Ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)
00:00-00:59	8.8	3.0	56.9	<0.1	7.5	45.0	39.7
.5	7.6	3.0	73.3	<0.1	9 .	50.9	43.0
2:00-02:5	7.1	•	95.1	<0.1	8.7	54.5	59.1
-0315	8.9		82.9	<0.1	6.8	54.4	61.1
4:00-04:5	6.1	3.0	64.0	<0.1	7.6	49.3	32.3
5:00-05:5	6.3	3.2	62.4	<0.1	9.3	37.1	22.2
3190-00	6.1	3.1	63.1	<0.1	9.1	42.1	23.1
-071	9.9	3.2	63.3	<0.1	9.1	42.3	23.1
0-08:5	6.7		62.5	<0.1	9.0	39.5	21.5
3-09:5	8.1	8.5	90.5	8.9	5.4	34.6	23.1
00-10:5	5.4	•	109.3	6.0	7.1	36.1	18.6
11:00-11:59	7.0	3.1	26.0	0.3	3 .3	34.8	18.7
:00-12:5	7.5	m m	57.4	0.3	8.5	32.2	15.7
	6.9		58.7	0.5	6.9	34.7	17.0
:00-14:5	7.1	•	57.5	₹.0	œ.	34.1	15.7
100-15:5	7.0	•	58.7	₹.0	.	34.8	17.1
100-16:5	6.9	•	58.4	0.3	6.	37.7	16.7
17:00-17:59	8.9 9	2.7	58.0	0.3	6.8	39.0	17.8
18:00-18:59	9	5.6	57.8	0.3	0.6	40.3	17.6
19:00-19:24	9 .9	3. 6	56.3	1.0	9.0	46.3	17.9

SUHMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 08/24/89 Test #:

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Test		AÉ	Afterburner Outlet	ıtlet		Flash Chambor Inlet	Flash Chamber Outlat
Time	02 (1)	(add) 0	AC _X (ppm)	THC (ppm)	(1) 200	THC (ppm)	THC (ppm)
09:1439:55	11.2	2.6	2 7 2				
**	10.8	, c				0.0	1.5
:00-11:	٠,		5.20	n (~ ·	0.1	1.3
:00-13:	6	, m	* 4 C	O 4	7.2	C. 0	7.4
:00-13:	7.6	7	7	n .	7.2	9:0	1.6
•	5	, ,,,	104.6			œ (. S
:00-15:5	4.6	er F	9 c	n w	· ·	0.7	٠. د.
00-16:	9	3.5	1.901	n ii	· ·		1.6
30-17:5	9.4	3.0	106.7		. r	7.0	1.2
8:00-18:5	4.6		106.3				₩. ₩
00-19:5	6.6		107.4	,	~ F	0.7	1.2
0:00-20:5	4.6		107.2	•	· ·	9.0	1.0
1:00-21:5	4.6		105.7	• • • •			1.1
:00-22:5	6.9		107.5	* -		ທ່	1.1
3:00-23:5	9.3		106.5	•	7.7	٠. د	1.0
)))		7.,	9.0	ø.

HAWINIORNE ARMY AMMUNITION PLANT HAWINIORNE, NEVADA

SUHHARY OF CONTINUOUS ENISSIONS HOWITORING DATA - HOURLY AVERACES

Test Date: 03/25/89 Test #:

15

		!																							
Chamber Outlet	(m ² 4) 3HJ,	1.6	••••••••••••••••••••••••••••••••••••••	6.0	6.0	1.0	6.0	0.0	6.0	0.8	2.1	H.3	1.4	1.3	1.2	1.4	1.3	1.3	1.2	1.1		6.0	1.0	0.1	1.0
ricsn Chamber Inlet	TIC (Ppm)	0.5	o.s	6.9	0.5	1.0	1.0	0.0	0.5	6.9	0.1	9.0	0.5	9.0	0.5	7.0	r. 0	7.0	0.5	8.0	4.0	e	4.0	4.0	0.3
	CO ² (1)	7.2	7.1		7.2	7.1	7.1	7.1	7.0	6.2	2.5	6.3	6.3	6.2	6.3	6.2	+.9	6.9	6.9	7.0	7.0	7.1	7.0	0 _	7.0
ıtlet	THC (ppm)	0.4	0.4	4.0	₹.0	7.0	♥.0	7 .0	₽.0	3.4	1.9	9.0	0.5	0.5	0.5	6.5	c.5	0.8	0.5	c.5	7.0	7.0	7.0	4.0	9.4
Afterburner Outlet	NO _x (ppm)	107.4	105.8	104.5	103.2	103.7	103.3	102.3	90.4	87.4	190.5	6. 85 6. 85	99.5	93.4	100.0	104.2	100.5	105.5	105.2	103.6	101.4	103.0	102.5	104.3	103.3
N.	(b ^F u)	2.6	2.7	2.5	2.5	→ .	•	2.5	2.5	•	9.1	•	•	3.1	•	•	•	•	•	•	•	•	٠	2.7	•
	02 (8)	9.3	4.6	7. 6	9.3	9.4	4 .6	4 .6	9.5	10.2	•	10.7	•		•	0	10.3	•	•	•	-:	•	•	9.5	•
Test	Time	0:00-00:0	00-01:5	2:00-02:5	3:00-03:5	4:00-04:5	9	6:00-06:5	00-07:5	8:00-08:5	9:00-09:5	0-10:5	:00-11:5	:00-12:5	3:00-13:5	100-14:5		6:00-16:5	7:00-17:5	:00-18:5		0:00-20:5	1:00-21:5	2:00-22:5	23:00-23:59

SUHMARY OF CONTINUOUS EMISSIONS HOMITORING DAYS - HOURLY AVERAGES

Test Date: 08/26/89 Test #:

5

							3 6 5
Test		AÉ	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Gutlet
Tine	02 (1)	(mdd) 00	(mcd) *ON	THC (pra)	co ² (1)	THC (ppm)	Tic (ppm)
0:00-00:0	1 .	2.6	102.7	0.4	7.0	0.5	6.0
1:00-01:5	,	•	104.4	4.0	7.0) m	. o
00-02:5	•	•	103.2	₩.0	7.0	7.0) .3
3:00-03:5	٠	•	102.3	4.0	7.0		, o
4:00-04:5	•		102.0	7.0	7.0	4.0) C
05:00-05:59	9.6	2.5	102.6	•••	7.0	. e. o	. o
6:00-06:5	•	•	101.9	9.0	6.9	7,0	. œ.
7:00-07:5	•	•	106.6	9.0	6.5) (°)
8:00-08:5	•	•	96.5	0.0	9	4.0) (-) (-
9:00-00:5			7.75	S.	(C)		7 -
0:00-10:5	•	3.2	97.0		8.9) (C	۲ در ۱
00-11:5			3.85	·.	9	9.0	
0-12:5			99.4		8.9) (C	· ·
10-13:5	•		100.2	. O	6.7	0.7	7 7
00-14:5	•		101.1	(C)	6.7	7.0	7
5:00-15:5	•	3.3	102.3	0.5	6.7	. e.	· ·
00-16:5	•	•	101.5	0.5	8.9	7.0	
00-17:5	•	3.1	101.3	0.5	6.9	9) (" • m
0-18:5	•		98.9	4.0	9	7.0) ~ 1 -
0-19:5		2.8	97.0	4.0	9	· (-)	?
.5			96.1	4 .0	o o) c	1 -
1:00-21:5	9.6	2.7	96.0	9.4	9	7) -
00-22:5	7.6		97.1	•••	9	•	10
3:00-23:5		2.6	4.66	7.0	6.9		

TEST RUN 16 600°F/6 HOURS

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

fest Date: 08/27/89 Test #:

9

						Flesi	Flash	ļ
Test		Af	Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet	
Time	02 (1)	(mdd) 00	NO (ppm)	THC (ppm)	CO ₂ (8)	THC (ppm)	TifC (ppm)	
00:5	9.7	2.6	96.6	1.0	6.9	0.5	6.0	ı
11:5	9.3	2.7	95.4	4.0	6.9	1.0	1.0	
12:5	9.1	2.7	6.96	7.0	6.9	₹.0	1.0	
315	9.7	2.7	97.2	₹.0	6.9	+. 0	1.0	
04:00-04:59	9.7	2.6	97.2	7.0	6.9	0.5	6.0	
512	æ.o	2.8	1.96	4.0	6.9	6.0	6.0	
6 15	8. 6	2.5	95.6	1.0	6.9	o.3	1.0	
7:5	11.4	2.8	19.4	9.0	5.1	3.0	3.0	
18:5	11.4	13.1	81.3	9.6	2.1	6.5	41.2	
9:5	•	60.3	145.1	3.8	1.0	7.9	9 .3	
015	ن	0	a.e	3.2	8.0	1.0	5.7	
11:5		3	7.7	2.4	1.3	1.1	6. E	
215	17.8	22.3	~. 9	2.3	1.3	~	2.6	
315	17.8	-	8.1	1.9	€.4	1.0	2.1	
4:5	•	~	æ.	1.8	4.4	ø. 0	2.1	
5,35	17.4	7	5 .0	1.9	9.4	1.2	1.9	
615	•	24.9	12.5	2.4	2.0	1.0	1.9	
7:5	15.9	4	15.6	1.8	2.6	6.0	5.1	
00-18:5	15.2	· .	22.4	1.1	3.1	-	1.7	
	14.3	12.5	33.1	9.0	3.8	1.0	1.8	
0:06-20:5	12.9	8.5	52.8	0.3	6.4	1.0	1.7	
:00-21:5	11.4	•	9.92	0.3	5.9	1.1	1.7	
100-22:0	10.7	5.8	86.8	0.5	6.5	<0.1	4	

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 08/29/59 Test #:

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						Plesh	Plash
Test		ΥĘ	Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet
Time	02 (8)	(bpm)	NO _x (ppm)	THC (Ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)
08:27-08:59	10.1	3.5	11.2	<0.1	6.7	1.0	1.3
09:00-09:59	10.7	3.3	3.6	<0.1	۳. ن	4.0	1.2
10:00-10:59	10.8	3.3	9.0	<0.1	9	0.9	: E
11:00-11:59	10.7	3.4	0.7	<0.1	.9	0.0	1.2
12:00-12:59	10.8	3.5	0.5	<0.1	6.2	4.0	1 4
13:00-13:59	10.8	3.6	56.4	<0.1	6.5	4.0	- E
14:00-14:59	8.01	4.1	8.2	<0.1	6.2	0.1	: e-t
15:00-15:59	11.1	7.5	*0.1	1.7	8.9	9.0	10.6
19-1615	10.9	3.6	50.0	٥٠.1°	6.2	<u>د</u>	N. C.
:00-17:5	8.01	3.6	105.6	<0.1	6.2	6.0	000
3-18:5	8.01	3.3	104.1	<0.1	6.2	e en	6.1
:00-19:5	8.01	3.1	105.1	<0.1	6.2	· 0	7
20:00-20:59	8.01	3.2	103.3	<0.1	6.2	9.0	· (**)
21:00-21:59	8.01	3.0	101.0	60.1	6.2	. O	1.2
22:00-22:59	10.7	3.1	103.9	<0.1	6.2	, O	
23:00-33:59	10.8	3.2	103.3	<0.1	6.3	6.5	· 6. 3

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 08/30/39 Test #:

91

Chamber Outlet THC (ppm) F) ash Chamber Inlet THC (ppm) Flash 0.1 0.3 CO₂ (1) THC (ppm) 60.1 00.1 <0.1 <0.1 <0.1 <0.1 <0.1 <0.1 Afterburner Outlet NO_X (ppm) 101.8 103.0 105.1 103.9 103.1 99.9 (mdd) 00 222220 8888290 02 (4) 8.01 9.0 8.01 0.7 ... 10.8 10.7 01:00-01:59 04:00-6j:59 05:00-05:59 90:00-00:00 03:00-43:59 65:90-00:90 08:00-08:59 09:00-09:25 07:00-07:59 Test Tire

TEST RUN 17 600°F/48 HOURS

Service and the form of the complete property of the property of the complete property of the co

SURJARY OF CONTINUOUS ENTSSICHS HONITORING DATA - HOURLY AVERAGES

Test Date: 09/01/89
Test 5:

Test		A£	Afterburner Outlet	ıtlet		Flash Chambar Inlet	Flash	1
Tine	02 (8)	(mdd) 00	NO _x (FPm)	THC (ppia)	(1) (00	THC (ppm)	THC (ppm)	
10:20-10:59	19.3	0 6			•			
11:5	6.81		••••••••••••••••••••••••••••••••••••••		0.5	0.7	11.9	1
00-12:5	2.5	200	n. c	20 (•	0.7	10.3	
:00-13:	17.6		D •		1.2	1.0	7.0	
:00-14:5	17.7		r h a	~ ·	(m) (0.1	6.9	
1515	17.6	25.2	7.0	- c	m, .	0.1	. 8.8	
16:00-15:59	17.2	28.3) u	.	0.7	11.5	
00-17:5	16.6		15.0		.		12.4	
100-18:5	15.8		9	4 8) ·	٠. . ه	v. 3	
100-13:5	15.1	24.3	24.3	• ·	9.	a.	6.2	
20:00-20:59	٦.		30.0	4.0	c	œ.	6.₹	
:00-21:5	12.9	9	. a	7.	 	0.5	3.0	
2:00-22:5	•	• ~	9 0		· · ·	0.7	2.6	
23:00-23:59	•	,		7.0	7.0	9.0	2.5	
	•	;	7 - 1 /	1.0>	9	10.4	8 00	

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 09/02/89
Test #:

								1
		;	,			Flash	Flash	1
Test			Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet	
Time	02 (%)	CO (ppm)	(prdd) ×ON	THC (ppm)	CO ₂ (1)	THC (ppm)	THC (Ppm)	
0:00-00:0	10.9	2.6		<0.1	6.3	39 7	517	1
:00-01:5	<u>.</u>	2.5		<0.1	ی و			
2:00-03:5	٠	2.4	53.7	<0.1	: œ	1 · • · • · ·		
100-0315	•			100			7.70	
4:00-04:5	6.7	2.4			• •	• • •	9/4/	
00-05			2 ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° °			7.1/	0.7	
6:00-06:5	•	2.5	54.6	1.0	. a) o		
7:00-97:5	•	2.6	56.2	* 0 • 1			7.05	
-08:5	•	•	57.9	<0.1) a	* c	7 - 0 7	
0-09:5	•	•	124.7	. ~		7.	6 .17	
-10:5	•	•	1 0		- a	7.00	21.3	
0-11:5	6.1	3.1	57.8			P. 60	7. AT	
:00-12:5	•		58.6			9.67 C		
13:00-13:59	•	٠	59.1		• a	7.90		
100-14:5		•	3.00) e	F 4 6	* · · · ·	
:00-15:5	•	•	61.5			- 62	P. 64	
100-1615	•	3.2	60.7		. G	• • • • • • • • • • • • • • • • • • •	9.71	
7:00-17:5	•	•	59.8	0.1	3 V.	1 v		
8:00-18:5		•	58.3	<0.1		7 V	7.67	
:00-19:5			56.9	. 0) ·	13.1	
:00-20:5		•	2,45		•	7.64	22.6	
1:00-21:5		•	• • • •	4 ·	7.0	5.27 -	21.3	
2.00-22.6	•	٠	9.0	7.0y	9.5	58.5	22.7	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		•		<0.1	9.5	54.1	22.4	
C167-001	•	•	57.9	<0.1	9.3	51.3	22.2	

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 09/03/89 Test #:

		AND THE RESIDENCE OF THE PERSON OF THE PERSO			distribution and descriptions and descriptions are described as the second of the seco	Flash	Flash	ı
F. C.		A£	Afterburner Outlet	ıtlet		Chamber Inlet	Chamber Outlet	
Time	02 (1)	(mdd) oo	(wđã) XON	THC (ppm)	CO ₂ (1)	THC (ppm)	THC (ppm)	
00:00-00:28	6.9	2.9	59.1	<0.1	9.3	54.5	23.1	•
1:00-01:5	•	•	59.5	<0.1	E. 0	54.5	23.3	
2:00-02:5		2.6	59.5	<0.1	4.6	53.7	22.2	
0-00:	8.9		59.2	0.1	9.6	58.6	24.0	
4:00-04:5	•	2.9	58.7	<0.1	9.4	53.9	25.2	
5:00-05:5	•	•	58.3	0.1	9.5	55.4	21.6	
6:00-06:5	•	2.6	57.8	0.1	9.6	ა. ლ.	24.1	
7:00-07:5		2.8	58.7	<0.1	æ.	0.09	25.0	
8:00-08:5	•	7.4		4.1	6.9	6.67	20.9	
9:00-09:5	٠			0.1	.	52.6	41.1	
0:00-10:5				<0.1	6.9	54.1	43.3	
1:00-11:5	•	3.1		0.1	e. 6	53.5	39.7	
100-12:5	7.3	•		0.1	7.6	52.4	38.5	
100-1315	7.3			0.1	9.1	49.9	33.7	
0-14:5	•			0.1	o. o	48.2	34.8	
100-1515		•		1.0	o .	47.3	32.4	
ij	7.4			0.1	o.	45.8	31.5	
:00-17:5	٠	3.1		0.1	a . s	47.2	34.3	
100-18:5	7.3	2.9		<0.1		55.5	40.1	
.5	 	•		<0.1	œ,	40.5	31.5	
100-20:5	7.2	2.7	60.3	<0.1		69.2	48.5	
	7.3	2.8		<0.1	## · 6	69.7	50.4	
:5	٠	•		<0.1	₹.	55.1	39.4	
23:00-23:59	•	3.0		<0.1	7.00	6.89	39.8	

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUHMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HUURLY AVERAGES

Tost Date: 09/04/89 Test #:

		1																							
Flash Chamber Outlet	THC (ppm)	46.3	4.04 50.03	29.9	5.2.3		63.6	65.0	52.0	0.39				7 7 7	0 T		. C. 7	71.0	y		7	1.00	7	, ,	
Flash Chamber Inlet	THC (ppm)	8.69	72.9	64.7	76.3	82.4	83.7	85.2	4.50	77.3) eq.	9 (9)	1 19	5.00	56.		1 (m) 1 (m) 1 (m) 1 (m)	52.5	53.7	5. Ac.	0 - 1 - 2		• •) o	. o.
	(1) (0)	9.6	7.6	. co	0.6	8.7	. 69	* .	7.2	9.3	8.7		œ.	œ.) CE	· cc				.	0) (c	1 C	1	5.6
tlet	THC (ppm)	<0.1	<0.1	<0.1	<0.1	40.1	<0.1	<0.1	0.1	<0.1	5.6	0.5	0.5	0.2	0.5	0.5	0.3	0.5	0.2	0.7	0.1	<0.1	1.0	0.7	0.1
Afterburner Outlet	NO (ppm)	60.5	6 0.4	81.3	60.1	62.0	62.4	63.1	78.2	62.0	68.3	64.5	65.6	65.8	67.2	6.99	9.99	9.99	66.5	1.99	62.0	73.0	103.4	101.9	₹.96
Af	(mdd) 00	2.8	•	•	٠	2.1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.7	•
	02 (1)		8.9	•	•		8.1		•	7.4	8.0	7.6	•	•	1.1	•	•	•	7.6	7.5	7.4	 00	11.8	12.0	12.0
4 6 8	Tine	00-00	1:00-01:5	2:00-02:5	3:00-03:5	4:00-04:5	5:00-05:5	00-06:5	7:00-07:5	8:00-38:5	9:00-00:5	30-10:5	1:00-11:5	30-12:5	10-13:5	4:00-14:5	30-15:5	00-16:5	30-17:5	00-18:5	9:00-19:5	0:00-23:5	1:00-21:5	0-2	3:00-23:5

HAWTHORNE ARMY ARMUNITION PLANT HAWTHORNE, NEVADA

SUHMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 09/05/89 Test #:

						Plash	Flash	
Test		AE	Aiterburner Outlet	rtet		Chamber inlet	Chamber Outlet	
Time	02 (1)	(mdd) OO	NO _x (ppm)	THC (ppm)	(1) 200	THC (ppm)	THC (ppm)	
0:00-00:5	12.0	2.9	6.96	0.2	5.6	0.8	1.8	
1:00-01:5	12.2	2.9	92.2	0.5	5.5	æ.o	1.7	
2:00-02:5		2.6	84.5	0.5	5.3	8.0	1.4	
:00-03:5	12.6	2.5	79.0	0.5	2.	0.7	1.5	
4:00-04:5	12.8	2.8	74.5	0.5	5.0	0.1	7.1	
5:00-00:5	13.0	2.6	9.69	0.5	6.4	9.0	1.5	
5:90-00:9	13.2	. •	64.5	0.1	4.7	9.0	→	
7:00-07:5	13.3	2.9	62.0	0.5	9. 7	9.0	F. 1	
8:00-08:5	11.8	3.2	87.7	0.5	5.7	0.1	1.4	
9:00-09:5	ø. 6	4.3	109.5	2.8	6.7	6.7	7.2	
0:00-10:5	•	•		5.7	-ii •	1.1	2.7	
1:00-11:5	9.8	3.4	122.6	0.3	7.5	6.0	2.0	
2:00-12:5	•	•		0.3	7.4	1.0		
3:00-13:5	9.6			0.3	7.4	6.0	1.9	
4:00-14:5	•		124.3	6 .3	7.4	6.0	2.0	
5:00-15:5	9.6	3.7	125.7	O.3	3.4	1.0	2.1	
:00-16:5	•	3.6		0.3	7.3	1.2	1.8	
7:00-17:5	•	3.6	124.9	O.3	7.4		1.6	
:00-18:5	9.6	•		0.3	7.4	8.0	1.9	
9:00-19:5	•	3.0	119.3	0.5	7.3	6.0	1.5	
0:00-20:5	9.8	•	120.4	0.1	7.4	0.7	₩. ₩	
:00-21:5	•	•	122.0	0.1	7.3	8.0	1.3	
22:00-22:59	9.6	2.9	120.9	0.1	7.3	9.0	1.4	
3:00-23:5	•	•	119.5	<0.1	7	9,0	1.3	

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS MONITORING DATA - HOURLY AVERAGES

Test Date: 09/06/89 Test #:

11

		A	Afterburner Outlet	tlet		Figsh Chambon Inlot	Flash
1991				3		CHAMPEL THIEF	Chamber Cuttat
Time	02 (1)	(wdd) 00	NO _x (ppm)	THC (ppm)	(1) 200	THC (ppm)	THC (ppm)
00:00-00:28	9.6	2.9	117.2	1 0>	- 6 6		
01:00-01:42	0 7	9	117	•	7 (· · ·	1.2
	•	• •	7 - 6 7 7	7.0>	7.7	9.0	5.1
AC:07-60:07	, ,	٥. ۲	127.8	0.5	6.9	7	
21:00-21:59	10.0	2.7	112.6	0 >	9	• •	7.
22:00-22:59	10.1		0 111		•	0.0	1.1
72.00-00-00	•		0.111	1.03	٥.	9.0	6.0
11167-00169	1.01	7.7	109.4	0.5	æ. •	<0.1	8.0

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HAWTHORNE ARMY ARMUNITION PLANT HAWTHORNE, NEVADA

SUBPARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 09/08/89 Test #:

Flash Chamber Outlet	THC (ppm)	<0.1
Flash Chamber Inlet	THC (ppm)	<0.1
	CO ₂ (V)	9.5
ıtlet	x (ppm) THC (ppm) CO ₂ (%)	<0.1
Afterburner Outlet	(mdd) XON	<0.1
Ŋ	0 ₂ (*) CO (ppm) NO _x	3.2
	02 (1)	19.5
Test	Time	10:25-23:11

TEST RUN 18 500°F/6 HOURS

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS MONITCRING DATA - HOURTY AVERGES

Test Date: 69/13/ Test #:

AVERAGES	
HOUKEY	
DATA -	
MONITORING DATA - HOURLY	
•	
9	

lot	(e														,				
Plash Chamber Outlet	THC (ppm)		<0.1	<0.1	<0.1	15.3	10.7	5.7	1.9	5.0	18.3	1.9	1.5	1.5	£.3	0 2	7	# · · ·	24.8
Flash Chamber Inlet	THC (ppm)		<0.1	<0.1	<0.1	~	4	15.9	2.9	E	30.9	6.0	6.0	6. 0	20.4	29.8	1	* * * * * * * * * * * * * * * * * * * *	8.57
	(1) 200		۰.۰	•	5.5		57 ·		0.7	.	o. o.		o.s	د د	0.7	0.7	6.4		7
utlet	THC (ppm)	. 0/		1.0	7.0	7.0	1.0.	10.0T	39 (٥.	·	•••	•	7.0	• • • • • • • • • • • • • • • • • • •	e. 5	e.0	0.2	1
Afterburner Outlet	NO _x (ppm)	22 5) u		0.0	, o 4		7.5) f	~ G	D, n.	7.1	•) ·	- C	7.0	61.9	61.6	
¥	CO (ppm)	13.5		. ·	7	. 4		77.	• a	` a		֓֞֞֜֞֜֞֞֜֞֞֜֞֓֓֓֞֓֓֓֞֞֜֞֞֓֓֓֞֞֞֓֓֞֞֓֓֞֞		•	• ") t		•	
	02 (1)	17.4	11.9	11.7	17.3	13.	-		· ~	٠.		α		α	•	•	£ . 7 I	0.11	
Test	Time	-	560	100-101	100-111	+00-12+	:00-13:5	00-14:5	00-15 z S	00-16:5	7:00-17:5	8100-18	9:00-19:5	0:00-20:5	100-21:5	3.00-00-6	C177-0017	0-7315	

HANTHORNE ARMY AMMUNITION PLANT HANTHORNE, NEVADA

SUMMARY OF CONTINUOUS BHISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 09/14/89
Test #:

78

Flash Chamber Outlet	THC (ppm)	1.4	2.9		1.0	1.0	6.0	1.0	1.0		2.6	16.3	23.9	23.3	24.4	32.0	2.77	28.9	26.3	6.90	7.70		7.40	2000	27.1
Flash Chamber Inlet	THC (ppm)	6.0	19.2	4.7	е.0	8.0	8.0	•	0.7	10.7	10.1	17.6	26.2	20.8	26.1	31.7	39.2	30.2	29.2	32.7	S ()) (C	1.05	6 TE	32.1
	(8)	1.2	6.9	7.2	7.2	7.2	7.2	7.1	7.2	7.4	7.2	6.7	6.2	6.2	7.0	6.2	0.6	6	e. 6	9.6	8.6	G. G.	9.5	9.5	6.5
tlet	THC (ppm)	20.4	→.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.3	0.3	0.5	3.4	0.5	0.1	0.1	0.1	<0.1	<0.1	0.1	<0.1 40.1	<0.1
Afterburnar Outlet	NO _X (ppm)	15.4	101.5	127.0	124.7	123.9	124.0	121.7	123.2	116.4	124.9	65.3	51.6	55.1	56.7	-	224.8	64.0	64.9	04.0	63.2	9.49	72.4	71.3	71.5
Af	(bpm)	7.3	8.7	5.3	5.1	n. N.	5.5	5.1	5.7	9.4	6.5	•	7.6	7.1	7.0	•	. s	•	•	•	•	•	•	9.4	6.3
	02 (1)	1 .	10.2	•	•	6.6	•	•	6.6	•	8.6	10.5	11.1	11.1	10.1	4.8	9.1	7.2	•	٠	•	•	•	7.2	٠
Test	Tine	00-00	1:30-01:5	2:00-02:5	3:00-03:5	4:00-04:5	5:00-05:5	-0615	7:00-07:5	00-08:5	9:00-00:6	10:00-10:59	100-1115	00 - 12:5	00-13:5	0-14:5	5:00-15:5	00-16:5	100-17:5	8:00-18:5	9:00-19:5	:00-20:5	1:00-21:5	2:00-22:5	23:00-23:59

HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS HOWITURING DATA - HOURLY AVERAGES

Test Date: 05/15/89 Test #:

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						Plank	Flash	
Test		Af	Afterburner Outlet	tlet		Chamber Inlet	Chamber Outlet	
Time	02 (8)	(add) 00	NO _x (ppm)	THC (ppm)	CO ₂ (1)	THC (pom)	THC (ppm)	
100-00:	7.2	6.4	70.9	<0.1	9.3	33.1	27.8	
1:00-01:5		6.5	76.9	<0.1	9.1	32.9	24.0	
100-02:5	11.7	5,3	116.8	<0.1	ъ. 9	1.2	O. 7	
~	12.1	5.3	93.1	<0.1	5.5	1.1	3.1	
4:00-04:5		5.1	81.0	<0.1	5.3	6.0	O.E	
5:00-05:5		5.2	75.9	<0.1	5.3	6.0	4.6	
6:00-06:5	•	5.2	72.1	<0.1	2.1	1.0	5.2	
7:00-07:5	12.7	5.3	a.e9	<0.1	5.1	e. 0	3.6	
:00-08:5	•	11.5	100.0	2.8	4.5	9.9	9.5	
9:00-09:5	-	•	121.4	0.3	4.1	ø.0	1.7	
0:00-10:5	٠	•	112.8	0.7	7.4	1.0	1.7	
1:00-11:5	•	0.9	115.5	0.5	7.3	8.0	1.9	
2:00-12:5	•	•	115.9	0.5	7.3	.	1.8	
3:00-13:5	•	•	115.2	0.5	7.2	o. 0	1.6	
100-14:5	•	•	112.2	0.5	7.2	0.7	1.7	
5:00-15:5	•	•	111.9	0.3	7.1	6.0	1.6	
6:00-16:5	•	•	109.8	0.5	7.1	0.7	1.9	
7:00-17:5	•		111.4	0.7	7.1	0.1	1.7	
8:00-18:5	•	S.	100.8	0.1	7.2	8.0	1.4	
9:00-19:5	•	•	106.3	1.0	7.2	0.7	1.4	
0:00-20:5	•		108.8	<0.1	7.2	9.0	1.4	
1:00-21:5	•		108.1	<0·1	7.1	0.7	**************************************	
	10.0	5.4	106.3	<0.1	7.1	9.0	1.2	
3:00-23:5	0	•	104.5	<0.1	7.0	9.0	1.2	

HAWTHORNE ARHY AMMUNITION PLANT HAWTHORNE, NEVADA

SUMMARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 09/16/89 Test #:

20

Test		AÉ	Afterburner Outlet	ıtlet		Flash Chamber Inlet	Flash Chamber Outlet	
Time	02 (8)	(pdd) 00	NO _x (ppm)	THC (ppm)	co ² (1)	THC (ppm)	THC (ppm)	
0:00-00:0	10.1	5.3	103.4	<0.1	7.0	9.0	1.2	
1:00-01:5	10.1	5.3	102.2	<0.1	7.0	5.0	1.2	
2:00-02:5	10.1	5.1	99.5	<0.1	7.0	0.7) (C)	
3:00-03:5	10.2	5.1	99.1	<0.1	6.9	9.0	0.1	
4:00-04:5	10.2	5.3	97.4	<0.1	6.	9.0	0,1	
5:00-05:5	10.2	5.3	96.0	<0.1	6.9	. O) 6. ()	
6:00-06:5	10.2	5.8	95.0	<0.1	6.9		0,-	
7:00-07:5	0	5.2	93.8	<0.1	8.9	0 6.0) (· · ·	
8:00-00:8	11.1	8.9	89.3	7.2	9.6	29.1		
0-0915	0	•	92.7	5.0	6.7	8,0	6.01	
100-1012	10.5	6.2	92.8	0.5	9.9	7.0	2.01	
106-1115	0	•	93.3	0.3	9.9	8.0	2.0	
0-12:5	•	•	92.5	0.5	9.9	9	9	
0-13:5	10.6	•	94.5	0.3	9) G	9	
:00-14:5	0		95.0	<0.1	9.9	0.7) 	
100-1515	•	5.4		<0.1	9.9	0.7	* * ·	
100-16:5	0	5.3		60.1	9.9	· 6.0	7	
100-1715	0	7 .5		<0.1	6.7		1.7	
100-1815		5.7		<0.1	6.7	1.2		
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23:00-23:59	10.2	5.3		<0.1	9.9	. œ	7) e-1	

HAWTHORNE, NEVADA

SUHHARY OF CONTINUOUS EMISSIONS HONITORING DATA - HOURLY AVERAGES

Test Date: 09/17/89 Test #:

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1161	(3)	
Plash Chamber Outlet	THC (ppm)	1.1
Flash Chamber Inlet	THC (ppm)	0.0 0.0 0.0 0.0
	CU ₂ (1)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ıtlet	THC (ppm)	60.1 60.1 60.1 60.1
ifterburnsr Outlet	NO (Ppm)	75.4 74.2 73.2 72.8 38.9
ÄÍ	2 (4) CC (ppm)	242448 402670
	02 (1)	10.2 10.1 10.1 10.1 10.1
Test	Time	00:00-00:59 01:00-01:59 02:00-02:59 03:00-03:59 04:00-04:59

APPENDIX F RAW ANALYTICAL DATA SHEETS FOR TEST ITEMS

The following information is provided in Appendix F:

• Chain of custody forms (Custody Transfer Record/Lab Work Request).

Data summaries from onsite analytical laboratory (WESTON

Analytics-Explosives).

Data summaries from offsite analytical laboratories.

Test data are presented for pre-test and post-test sampling events. The onsite laboratory conducted analyses for explosive compounds. The offsite analytical laboratory (WESTON Analytics Division, Lionville, PA) conducted the following analyses:

- Duplicate samples for explosive compounds (to verify analytical procedures of field laboratory).
- Samples collected from test items for smokeless powder.
- Samples collected from test items for ammonium picrate.
- Sample of gear oil from motor for explosives.

Analytical data summaries from the onsite laboratory provide the following information:

• Test Name (Pre-Test 2).

Sample Matrix (wipe, rinsate, solid).

Lab Identification Number.

Sample Description.

Dilution Factor.

Sample Volume.

Units of Reported Contamination.

Reported Level of Contaminant.

Sample results for wipe samples are reported as total microgram (ug); rinsate samples are reported as microgram per milliliter (ug/mL); solid samples are reported as microgram per gram (ug/g). If the analysis indicated that the compound was present below the method detection limit, the detection limit is provided and is preceded with a less than sign (<).

The detection limits vary based on the sample type (wipe, rinsate or solid) and the dilution factor. For TNT, the following detection limits generally apply:

- Wipe samples 19.2 mg.
- Rinsate samples 0.96 mg/mL (concentrations corrected to 1,000 mL sample).
- Solid samples 1.92 ug/g.

These detection limits are consistent with the limits outlined in the Test Plan (Section 5).

For the remaining analytes, however, some of the detection limits varied, due to high concentrations of TNT and required dilutions. The following example is provided for tetryl:

- The detection limit for tetryl in a rinsate sample was 2.5 ug/mL.
- Due to high concentrations of TNT in the rinsate sample, the sample is diluted by a factor of 1,000 to quantify the concentration of TNT.
- The detection limit of tetryl inadvertently increased to 2,500 ug/mL (2.5 ug/mL x 1,000 mL).

The mass or concentration of some contaminants is reported as a "J Value" (i.e., 3.36J). This indicates that the compound was determined to be present but below the detection level. The mass of contaminant is estimated.

The offsite laboratory data summaries include:

- Inorganic narrative (explosives narrative presented, where applicable).
- Glossary of terms.
- Inorganics data summary report.
- Inorganics quality assurance/quality control (QA/QC) report.

The inorganic narrative is generally a summary of the quality control results and a description of any problems encountered during the analysis of the samples. The glossary of terms defines the data qualifiers used in the report, abbreviations, and a laboratory chronology and holdtime report.

The ironganics data summary presents the actual results of the analysis. In addition, the lab sample number, site ID, analyte tested, result in appropriate units, and the reporting limit are provided.

The inorganics QA/QC report includes the anglysis of a method blank, inorganics accuracy report, and an inorganics duplicate spike report.

July 1900 Revision: Final

TEST RUN 2 400°F/24 HOURS

Discrepancies Butween Sample Labels and COC Record? Y N NOTES: Leaking (impreparty Sealed) 4 Unbroken on Sumple NOTES: Y 1 Present Upon Receipt 2 Ambient or Chiled 3 Present on Samule WESTON Analytics 4 Property Freserved 2 Unbroken on Outer 3 Recuired Broken 1 Shipped or Hand 1 Present on Outer 5 Received William Package Y Sangles Wore: Hoteling Tlanes Pachage Y COC Record Was: of Samples Y COC Tape Was: Use Out NOTES: NOTES: NOTES: NOTES: NOTES: ork. Combine patients from SR2 SRI Pre-wire its 1314/5 T. ATTA. Custody Transfer Record/Lab Work Request 40 Breelve 1 by se seller so Relingulaned by FISA Petters Armor ilitable 2 llew Resson Contadates/Volume AHALYSES PECUESTED Data रहा।।८ BAype Continues Dum solide Special instructions: Combine Jan Saalyse Relativement Pressryadya Time Metrix P. P. 0 Date 27 42 gallon decon Pet-2PIE P. 1. 5. 1. 7 Broeived by P * 7 7 # Ť Citant 10:Description 7 10 ž John Son Pie-wiPe CALIN USATHANIA /HIVAA P Pte . 1. 1. P DS - Drum Bollde DL - Drum Liquids Flush Flush Va137 Walt Order 22.31 - 08-02 WESTON Analytics Use Only N.Osher Belivelshad by 2907HU006 : : Ŧ = F. T. Track I 5R2 581 ख 381 - 5R1 ā Clerk Confect/Phone Maria W - Wster 0 - Os A - At NFW Contact Data Hac'd. AA Um Only Ruth Ryseum M . Sections 130 900 iloa d 500 200 500 100 Lag 400 did 9 व 1 र्भव 40 7

RFW 21-21-001/A-5/86

Discrepturides Beiween Sample Labele and COC Revord? Y N NOTES: 1 Present Upon Receipt 4 Unbroken on Sangde NOTES: Y 1 Present on Outer Pickage V 2 Unkroken on Outer Leaking (improperty Sealed) 3 Present on Sample 4 Property Preserved Y 2 Antiblent or Chilled NOTES: Samples Were:
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RFW 21-21-001/A-5/68

.. } WESTON ANALYTICS EXPLOSIVES

DATA SUMMARY

Analytical Lot.
Date Prepared
Date Analyzed Installation MAJINGGL POT Matrix: Paskie e salet.

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Comment: Ta PAE TEST

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Leaking (Impropert) Sealed) 4 Froperly Presonud
Y 2 Ambiant or Chilled NOTES: WESTON Analysics 3 Psceived Broken 1 Shipped or Hand-Delivered z 5 Received Within Holding Tunes Samples Were: COC Tapa Was: Use Only NOTES: NOTES: NOTES: NOTES: Custody Transfer Record/Lab Work Request きるが Containers/Volume Date Collected 712.8 #/Type Contains 2/28 ANALYSES REGUESTED Refrigerators Presorvative Matrix 30m AQ M.PPUS WIPE Client Contact/Phone 215-430-311 Client ID/Description RFW Contact MAZE/DI (2)465 Work Order 2281-08-02 2 SHR R WESTON Analytics Use Only T2 SUK! 1400AK PIOWHLORS Date Rec'd. _ 100 - 410 00%. TA Use Only 8 8 214.021 9

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FIFW 21-21-001/A-5/88	1-5/89							-	

7-118

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4 Unbroken on Sample NOTES: Y

7-2 POST TEST SAMPLES

Special Instructions:

DS - Drum Solids DL - Drum Liquids F - Fish X - Other

W - Waler O - Oil A - Air

3.6

SE - Sediment 50 - Solid

3 Present on Bample

2 Unbioking on Outer

Package Y

1 Present or Outer

Package Y

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only

Sample Labels and COC Record? 1 Present Upon Receipt 7:118 4 Unbroken on Sample NOTES: Y Discrepandes Between Package Y 2 Unbroken on Outer Package Y Leaking (impreperty 3 Present on Sample 4 Properly Preserved
Y 2 Ambient or Chilised NOTES: 3 Received Broken/ 1 Present on Outer WESTON Analytics 5 Received Within of Samples Y 1 Shipped or Hand-Dalivered COC Record Was: Holding Times COC Tapa Was: Samples Were: Record? NOTES: Saaled) NOTES: NOTES: NOTES: Use Only HOTES: E E Date Received by POST T-2 SAMPLES EX - EXPOSIUES Pylinguished by 16.4 B 3 Hem/Resson 22 (Ha 3 X Containers/Volume Diste Collected ANALYSES PEGUESTED 7/28 7/28 7/28 #/Type Container 7/28 1/28 Refrigerators Freservative Time Mastrix . MICE WIP: WIPE EIG Special Instructions: Drie Date Recid. MAZELECT, PLACHASCO, OCECTOR SCIENT CONTECT FROM 215-430-3117 TOP Received by FLASH CHAD WALL WI Cuent ID/Description N/ DS - Drum Solids DL - Drum Liquids F - Flah X - Other W 7 として Client LEATHANIA ME, 1 AAP -2.5HV RINXE Work O/Jay 22 81-03-02 T2 5581 WI T2 5M W STEEL PIPE Relinguished by PIOWEL SES 180-410 Rum/Fleason 008 012 300 014 THE SECTION MA Use Octy 18 600 970 6/0 5/0 110 10 - Build

RFW 21-21-001/A-5/88

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WESTON	WESTON Analytics Use Only	Custoc	ly Tra	ınsfel	r Rec	dy Transfer Record/Lab Work Request	ork Requ	est		WHO THE	ì
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WESTON ANALYTICS BIPLOSIVES

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WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

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Analytical Lot
Date Prepared
Date Analyzed

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1, 3, 5-THB	₽. OE ≯	£.06.*	4.04 >	4.06.	P. Q. >	P. OC >	4 20.9	F.06.	\$ 0.€ \$	4.06.٩	41.05
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Tetryl	0,02.4	4 50.0	< 50.0	¢ 50,0	4 50.0	C.05	¢ 50.0	< 50.0	4 5.0	< 50.0	50.05>
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Notes Data is corrected for dilution, .

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ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20
RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were widnin the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager

Dehville Analytical Laboratory

7/2/90

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INCREMNIC REPORTS

Park.

DATA OUALIFEERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Natrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or B'ank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDETME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICF digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eq. HAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I* 10- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/20/90

	R: 2281-08-02-0000		MESTUN	BAILH #:	8908L20
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTII LIMIT
-001	POST TS-FLSK CHMB WA	NITRATED ESTERS	5.0 u	UG	5
-002	POST T2-SHIP MINE	NITRATED ESTERS	5.0 u	UG	. 5 🕏
-003	PRE T5-SHIP MINE	NITRATED ESTERS	5.0 u	UG	5 *
-005	PRE T5-BLANK WIPE	NITRATED ESTERS	5.0 u	UG	5 .

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	USATHAMA-HAWTHORNE ER: 2281-08-02-0000		WESTON	BATCH #:	8908L203
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

	SATHAMA-HAWTHORNE R: 2281-08-02-0000			WESTON BAT	CH #: 89	08L2(
SAMPLE	SITE ID	AHALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RE(
******	**************	***************	******	****	*****	===:
BLANK10 BLANK20	89LNC008-MB1 89LNC008-MB2	NITRATED ESTERS NITRATED ESTERS	10.8 49.5	2.5 u 2.5 u	10.0 50.0	108 99
		NITRATED ESTERS	49.5	2.5 u	50.0	95 4

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE WURK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L203

SITE ID

SAMPLE

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF **ANALYTE**

BLANK20 89LNC008-MB2 NITRATED ESTERS 99.3 99.0 0.20 TEST RUN 3 500°F/36 HOURS

Ent 15

RFW 21-21-001/A-5/86

7.118

WESTON	WESTON Analytics Use Only	Custod	ly Tra	ınsfer	Rec	o.d/Lab	Custody Transfer Reco.:d/Lab Work Request	uest		WASSEALT!
8407	200MHTOPS		Refrigerators	store						WESTON Analysics
(KATHAM A	ATHAM A	1	#Type C	Mype Centralist				-		Sandes Were:
E STORY	77.91.08-17		Contekn	Contehens/schuse						1 profiped or Hand
Work Order			Preservative	dive						NOTES:
HFW Conft.	زيمحالا	20	AWAL	ANALYSES -	7					
Client Contact/Phone	-		REQU	REQUESTED) (s					2 Ambient or Cillied NOTES:
WA Use Only	Clent lor	Client ID/Descripiton	Maleria	Date Collected						3 Racelved Bruken
	13 561 14	11 - W. Y.	2117	714/29						Leading (kingsings)
200		Piewing 42	4.1.7							(Septem >
\$00	T3 521 P.	Perwise #3	20.03							ES:
7.23	To SRI P.	Pirwing #4	13.00							Brosselv Branch
992	ि ५६१ मि	Per 10,30 45	17.17							
200	(13 5R) dr	Accor Tie Spike	11.30							NOTES:
703	73 SR2 Pr	Personse di								S Roselved William
88	T3 582 P	P11. W.17 M2								HAAng Tinns
600	13 502 F	Per wife H's								NOTES:
010	13 582	Becomite "y								
100	13 582	Promit #5								COO Tare War.
012	13 583	Min Per Milk	→	71						1 Present on Outer
013		Fivin	1.40.6							Package Y N
PIO.	73 P32	Flush	7	1	/					
ロシロ	57/15/09									2 Present on Sample
	- j	Hilds Epocial Instructions:	ikona:	0	•	,				4 Chbrokes on Santie NOTES: Y N
80 - E-Zed	A-AF F.Fish K-Other			Y - W -		1				
Noca Recoun	Reducedabled Dr	Baredised by D	Deia Tiera		Hemilianon	Bringulabed by	Received	1	That	3
									Ī	of Samples V
										Discrepandes Balweur Sarrde Lebals and COC
			+	1	1					Recud? Y N
			+	+	1					NOTES:

WARTHAN 4 Unbroken on Samplo Sample Labels and COC 1 Present Upon Receipt Leabing (Irreproperty Discrepandes Belwayn 4 Properly Preserved 2 Amblent or Cliffed NOTES: WESTON Analytics 1 Shipped or Hand-Delivered NOTES: 2 Untroken on Cuter 3 Present un Bample 3 Received Broken z 1 Present on Outer 5 Received Within Bamples Ware: Holding Times > Package Y of Samples Y COC Record Was: COC Tape Was: Packupa Sauled) NO FES: NOTES: NOTES: 10.10 Custody Transfer Record/Lab Work Request P Received by Reilmoulehed by (4 Ham/Reeson ANALYSES PEROUESTED Contiduate Noticine Date Collected 2011111 PAY Mype Centalner Reinperators Preservetive Thin Habrier ... 17:2 710 Spacial Instructions: Date 248 1, 4:01 P. 1. 201. 125 Flosh Received by Ass LUBY DOIN Cleat libroscaipiden P. C. - 13.7 flux. f(0)h1157 Flush Pute Due 6 14 4 DL - Drum Liquids Dis - Drum Schou 3731-07 WESTON Analytics Use Only 8907 HW 002 5/1/K2 SIIR Relivingslohed by X - Other 1154 i 11.1.11 A F. Fig. Sik SHK 511 3 581 गुलाहर ジジス Clent Cuntect/Phone 0.0 A.≵ Work Order -RFW Contact Date Rec't. IA Use Only Kem/Reason Me - Bedissont BO - Bedid 91 020 910 660 370 770 9/0 670 020

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FFW 21-21-001/A-6/88

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RFW 21-21-001/A-5/88

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WESTON ANALYTICS EXPLOSIVES

DATA BUNHARY

Installation Hauthor to the Date Analyzed The Lot Date Analyzed The Lot Date Analyzed The Lot

Unite envares-ug-2 unites: bell- a Analyst gam los Reviewed

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- PRE TEST Connent: TESE 3

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LAB ID \$	8	600	8 8	- 600	-400 600	-600 -600	-i 700	- 400 000	-400 500	- 19 00 00 00	ر د ٥٥
	T3 : R1	135E1			13 SA.1	13 561	TB SR1		13 56.1	T3 56.1	T3 5C2
ארורוב סביני מרושו חוב	2	10 22	E # 324	20.33	1000	FRE 23	50 300	CEL * 5	7	44.60	3
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Church Volume]	-	1	ı	١		١		ł	1	
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них		244	450		المهرو)	r.	181	: م		E18) 416	
RDX		, 58 (158		720		(443	116.		585	1,25,1	1
1, 3, 8-TNB	4804		6.062		٦.05>		4 20.9	P.0E7		6.067	\$. \$
1, 3-DHB	45.90		45.90		45.90		45.90	45.90		45.90	45.90
ax ax	5.601		\$. to #		48.3D		44.20	64.20		06. Y >	1.26×
Tetryl	450.0		450,0		<50.0		6593	450.0		450.0	450,0
2, 4, 6-THP	E.P.>		6.PI2		4.44		419.2	49.1		4.912	6.912
2, 6-Dat	44.00		00.H7		44.00		44.00	87.7		C4.00	8.7.
2,4-DNT	0E'h>		0E.4.2		9E.Y.2		مد.٢>	06 h7		04.42	04.4v
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WESTON ANALYTICS RIPLOSIVES

CATA BUMMARY

Installation HALLICOTORISE TO Date Prepared

Installation HALLICE STATE

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Reviewed

Note: Data is corrected for dilution, .

Comment: TEST 3 - PRE TEST

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7	-600	100		8	Я	المساهب		4440	41050	2295	2310	23500	5500	1	0157	مدار
d	-500		FLUISH	-	1000	اهمامي	•	40,490	41.05	395,02 SPE.02	40,210,40.210	42.5	4 Q 960 40.96D	20.200	ore'oz	عااد
الح ا	- K00	200		-	0001	المراجي	co.635	40.44D	41.05	~0.2AS	40,210	5.62	८ व वक्ट	0.300	סוביה סובים>	مالد
3	- 600	1,		-	j	Hard an Lafell not have an Lafell an Lafell	7.55	1 .	4.06.4	25.90	10.01	450.0	6.912	44.00	44.30	רוור
3	-600		13 Sec. 15	-	1	total us	149	ار عوم	430.9	-5.90	24.20	450.0	<19.2	64.00	مد.٢٠	LIL
3	-600		200	-		hoked year	LSI	لـ ا		45.90	44.30	450.0	E.912	c4.00	oth>	11/2
3	-400		Pre	_	1	 Haked we	, ree	418	-	45.90	24.20	450.0	419.2	24.00	05.42	Lift
3	-600	वर्ट	13563			 Hotal na	305			45.90	96.42	0.0	6.612	<4.00	4.30	rife
2	- E00	100	000	C		 Habel we		2		7				7		Life
MATRIK	148 ID •		Amy and control of the control of th	Dilution	(E) who is represented to the second	Sman!	жн	RDX	1, 3, 5-TNB	1, 3-DNB	KB	Tetryl	2, 4, 6-THT	2, 6-DHT	2,4-DHT	anlac bate liney

RESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

RFW Batchesonhwoosloodlood Analytical Lot Installation HENTHOLDE Date Prepared

Date Analyzed Linguist Analyst
Date Analyzed Linguist Reviewed

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Note: Data is corrected for dilution,

Hatrix: PINSATE LUNEE & SOIL

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Comment: TEST 3 - PRE TEST

HATENE LAB ID (- E00	A-600	- F00	8 -E00	A 000	-500	-400	-E00	-500	(T)	- 400
	רומ	310	910	610	050	150	650	650	೧೨५	350	100
	TE SHV I	Eans E1		TBSHUL	TB SHV.	EANS EL	13881.		43 69		ر با 3 ما
Dilution 10	0,	01 1		-	S North Parket	-	1	uem	000'01	-	१ १ १ १ १ १ १ १ १ १ १ १ १ १ १ १ १ १ १
(ELM)	1000	1000	1000	\$	2000	0001	300	300			
	فساهنا	0-1-	هاما	9-8-	a-18m	همامي	9-10-	anlyn	9-18	Haich Co	Hotal us
		20,635		20,635	\$67.07			1	412700	L.E1.2	1.7.1
		40,490		20,490	40.440	490	1.19	981.0	49800	44.BC	3.8
1, 3, 5-THB		4 1.05		<1,05	30,12	co.12	41.05	41.05	209000	A.067	P.057
1, 3-DNB		20.295		20.295	56.00 SPE.02	295.03	40.295	0 57 00 5 7 586,02 65.90	4 59CD	45.90	45.9.0
		20.210		012.07	סיבים>	०१७:०>	000th 015.02 015.02 016.02	015.05	2000	8.C.SK	18.1 1
Tetryl		<⊋.50		42.50	23.50	42.50	43.50	23.50	20000	1 7	
2,4,6-TNT		40.940		40.940	< 0.4.0	6.0,9is0	< 0.9.0 C. 0.9.0 C.0.9.0 C.0.9.0		153500	1	6.612
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walue oate	1116	ماله	31/1-	عاله	-: 110	ع، إر ا	عارو	عاد	76/1	110	UN

WESTON ANALYTICS BIPLOSIVES

DATA BUKKARY

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Note: Data is corrected for dilution,

POST TEST Comment: IEST 3

HATELK	3	ď	7	æ	ď	3	ď	øt.	Z.	¥	B
LAB ID 4	-500	-609	-600	-600	-600	-600	-600	-600	-p00	-63	-010
	100	100	. 500	500	6004	2005	200	C00	800	600	100
	T3 PB	13961	13501	13981	13 601	13 98	TS SHRI	T3 SHR !	TS SHEL	TS SHR.	Ta Suti
SAMPLE DESCRIPTION PRE	PRE	ALUSE + 1	41 KINSE . D ENSE . 3		RINSE PLA	13	anst at	\$ 0 3 CM18	Ca Becara	ביוענים פיע	RIUX -1
Dilution	-	-	,	,		_		_	-	_	
SAIRPLE WOLLDER	1	8	1000	83	2000	1	300	300	300	300	1000
Used \$	14 ded was 1 mg/-	فداهد	همالهما	عساهم	وساهم	Hate June	8-12	anlan	4-18	9-10-	فسنيما
жж	L.E.2	20,03	561,02	587'07	557.07	L.E.12	56707		25.00	289.07	359,07
RDX	49.80	40.490	40.440	C0,490	20,490 LD,49C	49.80	co.uqo	Obh'07 08h'07 Ubh'07	20.490	40,490	40.490
1, 3, 5-TNB	017 61067	41.05	41.05	41.05	41.05	6.06.2	41.05	41.05	41.05	21,05	50.12
1,3-DNB	45.90	40.245	40.245 40.245	20.245 40.245	40.295	45.90	40.295	295 40.245 40.245	20.≥A5	40.395	<0.295
4.0	B.Lo	012'07	01E:07	مد.02	016.02	æ €,'0€	015.07	40.310	20.210	015,02	40.210
Totryl	450.0	62.50	42.50	05.E.	05.E>	0.057	43.50	05.E7	62.50	< 2.50	03.E2
2,4,6-TNT	6.912	LUAMO	40.040	076.07	20,940	E.P12	40.946	40.960	40.940	2.43	20.940
2,6-DNT	24.00	٥٥٣،٥٥ م٥٠٨>	C0.200	000.07	20.300	24.00	00 ac	00 کا میں ۲۰		∞6.02 ∞6.02	40.300
2,4-DNT	וביטא סביא>	၁	סביאים סוביסם סוביסם סוביסם	20.210	ماه.٥٥		012.02 015.02	015.07	40.210	015.02	015.02
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WESTON	WESTON Analytice Use Only	Custod	y Tran	sfer F	3ecc	ord/Lab W	Custody Transfer Record/Lab Work Request	lest		MEDICAL
840	800mHLOP8		Reirigenators							WESTON Analytics
-		applial.	8/Type Conteiner		7	104				Sanctes Water
Calent - Lt	2201-00	2.	Containara/Volume	_	#					1 Supposed or Hand-
Work Order	2 02 2022		Preservative		Sec					Delivered NOTES:
RFW Contact	BEN CONTROL MIKE MAZZION / NAKON JOHNS	WAKEN TOPASA	ANALYSES	1				_		
Client Contact/Phone	cuPhone		REQUESTED		تخبو					2 Anthent or Chiled NOTES:
WA Use Only		Client ID/Description	J							3 Received Brokens
8	T3 PRI RI		/a 1/	<i>iβ//7/L</i>	×					Leading (hipsiparty
600					X					\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
600	73 181 R3				X					NOTE8:
100	T3 PB1 R4				X					4 Procesty Preserved
					+			_		Z
900	T3 PB W1				7	×				HOTE3:
								_		5 Received Within
900	TA SUR! C	1			×					Holding Three
100		83			X					NOTES:
800	SHIR. I	6.3			×					
600	SHEL	7.			X					COC Tage Mas.
										3
										Package Y N
										Parkage Y N
										3 Present on Sample
Marchin 8 - Scill 82 - Scillmant 80 - Salid	W - Water DB - Brunt Bolida O - Oil BL - Brunt Liquid's A - Air F - Fish A - Catar	olisa Special instructions: Iquida	ions:		7-3		Post TEST S	SAMPLING	אווופ	4 Unbroken on Sample NOTES: Y N
Perfer Newson	er Retireguletiest br	Received by Data	fe Tat	item/Reason	 	Relinantabed by	Recuired by	Dele	Sile	COC Record Was:
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			-		\dagger					Distrepandes Behraen
			-		T					Sample Labels and CCC
					H				T	-
RFW 21-21-001/A 5/88	01/A 5/84									7:1:4

RFW 21-21-001/A-5/88

WESTON ANALYTICS EXPLOSIVES

DATA BUHMARY

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Note: Data is corrected for dilution,

(00-500 EXCELT FOR POST TEST Comment: TEST 3

HATRUK	3	7	Ų	ď	ď	3	귈	¥	ي	ų	В
1.48 ID 4	-500	-600	-600	-P00	CV3A- CO34	-600 200	- 600 000	1000	-620 500	-600 009	-010
	T3 PB	13961	13501	13 661	13 601	٥	—			_	
SAMPLE DESCRIPTION PRE	PRE	RIUSE + 1	KINSE . BUSE .	ENDER 3	RINSE P.4	7	RNJE AL	#1178 # 3	RINSE & S	בוציים בינו	Kink wil
Dilution	-	-		1	-	_			-	_	-
(com	1	1000	0001	2001	0001		300	300	300	300	1000
Una 18 5	total as we	فساجما	d. 1	هداهد	ئ. لوم	hate Later	g., 53	anlan	4-18-	م امر	فدايم
HMX	ריבוץ	20,02			26.02	L.E.1-	38707		1	557.07	25.0.02
RDX	C. F	044.07	40.440	C0.490	OH1107	49.80	26,440	064'07	06h'07	064'07	40.490
1, 3, 5-TWB	P.06.2	41.05	د١.٥5	41.05	50.12	P.06>	41.05	41.05	41.05	21,05	50.12
1, 3-DNB	<5.90	20.295	20.245 20.245	20.295	40.295	25.90	Sr. 275	20.245 CO.295	20.295	40,295	<0.395
яя	B.LOK	B. LOK 20.210	01E.07	مدي	015.07	30.5€	014.0	40.210	CO.410	20,210 <0.210	20.210
Tetryl	250.0	62.50	ري. دع.چې	¢≅.50	42.5c	450.0	-3.50	42.50	ca.50	4.2.50	05.62
2, 4, 6-THT	6.P12	20 ALD	40.940	0016.00	C76'07	4.9.2	40.960	096:07	20.940	2.43	20.54co
2,6-DNT	c4.00	00ه.02 00.42	005.02	000.00	00 2 .02	44.00	00E.02	40.360	20°.02	00,300	4.0.200
2, 4-DNT	ag.h>	טוביטא מביאי	016.07	015.02	סביאים סוביסי סוביסי		015.02 015.02 015.02	20.210	015.05	015.02	0.2.0 015.00
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WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed The ILEGALISH SA RFW Batchevernessericestreles Installation Heatherne Matrix: Sersertander & Som

Unite ensaigne units unestanting Services Analyst Open

Note: Data is corrected for dilution, '

Comments TEST 3 POST TEST

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	13 541	THE ST THE ET	TESHUI	43 67	we as	T1 391	TB 38.1	T3 5A1	T3 36.1	T3 5R1	T3 581
SAWALE DESCRIPTION RINSE - DEMISE - 4 51	Quest -	QUINSENS	R. ILISE . 4	51	.3	19	63	5	73	\$33	20 6
Dilution		***		1	-	-		ب	_	_	
SAMPLE YOURNE	000	1000	1000			•	ı	•	1	1	1
	apallo japan ja										
Sum	an lan	anten	عداحم	المام	ما لعلم العلام	Asted was	Hotel us Hotel us	20 158	they was Higher was trained was	Asted us	15.4 ve.
них		20.03	40.635	LE:1-	< 12 A	r.E12	L.E12	1.E12	C12.7	F.E12	L.E1.2
RDX	40.440	co.440 co.440	CO.496	<0.980 c4.80	c4.80	49.80	KA.80	49.80	69.80	< 9.80	c4.80
1,3,5-THB	41.05	<1.05	<105	4 2.09	9.05>	٩٠٥٤ ١٠٥٤٦	4.0E.2	4.05.9	6067	69.67	4.052
1, 3-DKB	2C.295	26.295 20.295	40.295	<0.590	< 5.40	4.6.9.e	65.90		45.90	45.90	45.90
KB	4.0. 210	COEDS	20.216	en'07	* 6.4%	* C.O.	9.63.4	8.59 4	€.63 ×	(3.0 to	* 1.71
Tetryl	42.50	50،50	c2.50	450	0.057	450.0	450.0	C.50.0	< \$6.0	£50.0	650.0
2, 4, 6-THT	40.940	CO.CHO CO.OHO	C.O.940	c 1.92	£.91.2	c.912	E.P12	£/9.2	K. P1.2	6 (B. 2)	419.2
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P POSSIBLE CONTAMINATE

WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

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ote: Data is corrected i	Omment: TEST 3.

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WESTON ANALYTICS EXPLOSIVES

DATA BUMMARY

Installation Hausing Date Prepared Hatrix: Sustantian Date Analyzed Thanks

Units value Analyst opm Reviewed

Note: Data is corrected for dilution,

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Dilution	!										
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WEBTOH ANALYTICS EXPLOSIVES

DATA BUNHARY

Unite Anglow Analyst Gast Analytical Lot
Date Prepared
Date Analyzed R W Batch Installation Matrix:

Notes Data is corrected for dilution,

Comment: T3 Post TEST

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WESTEN

ROY F. WESTON, INC. Lionville Labouatory

CLIENT: USATHAMA HAWTHORNE

SAMPLES RECEIVED: 07-19-89

RFW #: 8907L058 W.O.#: 2281-08-07

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LWO2, Explosives in Soil, modified for the analysis of wipe samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

SSD - Designates sample spiked with target compound.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample

interference.

NR = Not reported.

NOTE:

Spikes have been reported as result (% recovery). Method holding time of seven days way exceeded for sample preparation. This holding time is applicable to soil samples. Although this holding time is exceeded, lab experience with the long term stability of explosives compounds provides an indication that the data obtained is quite likely to be representative of initial explosive concentrations.

WESTEN

Data Qualifiers

Enalysis Summary:

Samples Collected: 07-14-89 Samples Prepared: 07-25-89 Samples Analyzed: 08-10-89

Approved By:

George Perry

HPLC Unit Leader

Lionville Analytical Laboratory

HESTON ANALYTICS WIPE EXPLOSIVES DATA

RFW Batch Number: 8907L058		USATHAMA-HAWTHORNE	Page: 1
Client			1 1
Sample Information RFW#:	REWIPE 3	2XSS	10XSS
-			H
Units:		H	
	. < 12.7	2.36(92.9%)	11.8(92.9%)
RDX	08.60	1.75(89.2%)	8.95(91.3%)
1.3.5-TNB	V	3.84(91.8%)	18.8(90.0%)
1.3-DNB	٧	1.15(97.4%)	5.66(95.94)
NITROBENZENE	< 4.20	0.73(86.9%)	3.55(84.5%)
TETRYL	< 50.0	11.3(113%)	62.5(125%)
2.4.6-TNT	< 19.2	3.56(92.7%)	18.2(94.8%)
2,6-DNT	· · • · · · ·	0.75(93.8%)	3.66(91.5%)
2,4-DNT	< 4.20	0.75(89.3%)	3.64(86.78)

D.F.: Units: Total ug HMX
2, ć-DMT



ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,3,10,16,20,22,29, 9-2,11,20 RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountared during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as separate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager

Dionville Analytical Laboratory

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- Indicates that the original sample result is greater than 4x the spike amount added. The USEFA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicats.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spiks.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpraced as follows:

MAAW - Metals prep test for AA digestion, water matrix. MAAS - Metals prep test for AA digestion, soil matrix.

HICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eq. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eq. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L058

REPORTING LIMIT SAMPLE SITE ID ANALYTE RESULT UNITS -001 T3 SM PREWIPE #2 NITRATED ESTERS 10.0 u UG 10.0

ROY F. WESTGN INC. INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	JSATHAMA-HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8907L05
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0 u	MG/L	5
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0 u	MG/L	5*

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8907L058

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10 BLANK20	89LNC006-MB1 89LNC006-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	9.0 46.7 48.9	5.0 u 5.0 u 5.0 u	50.0	90.0 93.3 97.7

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-G8-02-0000

WESTON BATCH #: 8907L05

		,	SPIKE#	SPIKE	2.
SAMPLE	SITE ID	ANALYTE	%RECOV	%RECOV	%DIFF
	*******	*************	我看着我就	*****	*****
BLANK20	89LNC006-MB2	NITRATED ESTERS	93.3	97.7	4.6

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L059

REPORTING SAMPLE SITE ID ANALYTE RESULT UNITS LIMIT -001 T3 CHAMP WELL PW SP NITRATED ESTERS 10.0 u UG 10.0

ROY F. WESTON INC. INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 WESTON BATCH #: 8907L059

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTIN LIMIT
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0 u	MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0 u	MG/L	5. 3

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INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 WESTON BATCH #: 8907L059

		•	SPIKED	INITIAL	SPIKED	
SAMPLE	SITE ID	ANALYTE	SAMPLE	RESULT	AMOUNT	%RECOV
*****			*****	******	****	*****
BLANK10	89LNC006-MB1	NITRATED ESTERS	9.0	5.0 ช	10.0	90.0
BLANK20	89LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93. 3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

SAMPLE

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L05

SPIKE#1 SPIKE#2 %RECOV %DIFF SITE ID ANALYTE

BLANK20 39LNC006-MB2 NITRATED ESTERS 93.3 97.7 4.6

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK GRDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

REPORTING SAMPLE SITE ID ANALYTE RESULT UNITS LIMIT

-001 T3SMW2 NITRATED ESTERS 5.0 u UG 5.0

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INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT:	USATHAMA-HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8907L154
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTII LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5 u	MG/L	2.
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5 u	MG/L	2.**

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8907L154

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10 BLANK20	89LNC008-MB1 89LNC008-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	10.8 49.6 49.5	2.5 u 2.5 u 2.5 u	10.0 50.0	108 99.3 99.0

INORGANICS CUPLICATE SPIKE REPORT 02/20/90

SAMPLE

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 SITE ID

WESTON BATCH #: 8907L1!

SPIKE#1 SPIKE#2
%RECGV %RECOV %DIFF ANALYTE

89LNC008-MB2 BLANK20 99.3 NITRATED ESTERS 99.0 0.20 . TEST RUN 5 500°F/24 HOURS

1311R2

z 4 Unbroken on Sample 1 Prosent Upon Receipt Leaking (Improperty Sealed) 3 Present on Sample 4 Property Presurved 2 Unbroken on Outer 2 Ambient or Chilled WESTON Analytics 3 Received Broken 1 Shipped or Hand-Delivered 1 Present on Outer z 5 Received Within CCC Record Was: of Samples Y Holding Times Package Y Sangles Were: COC Tape Was: Package NOTES: Use Only NOTES: NOTES: NOTES: NOTES: HOTES: Time **Custody Transfer Record/Lab Work Request** Date PRE TEST Received by Relinguished by Arteires. State 12 تجدوا وسد Ŝ 4 Jack Control 8 Ito. Wiesson 1.38.CJ Containers/Volume בים -נות -ני Collected ANALYSES PECUESTED #/Type Container Refrigerators Date Preservative Time Matrix 3217 30.0 Special Instructions: 200 Hecelvad by Client i D/Description DS - Drum Solids DL - Grum Liquids F - Fish -Date Due Client PACATRES INCHES Work Order Back - C'S - C'S Ind. Reason | Relinguished by WESTON Analytics Use Only - Other 3907HWOUL SAN ONE لجنع يعملك %·Water 6-Cu ≥-Ate Client Contact/Phone RFW Contact_ Date Rec'd. _ WA Use Only SE - Sediment 000 Libo 8 SC - Solid

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Sample Labels and COC Record? Y N NOTES:

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WEBTON ANALYTICS BIPLESIVES

DATA BURHARY

Units Lange Analyst Analyst Reviewed Analytical Lot
Date Prepared
Date Analyzed KFW Batch englassing Installation parameters Matrix: Work & South

Notes Data As corrected for dilution, .

Post

Comment: T.S. Bag- Term

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MATERIA IN	Stande Bestingtion	Dilution	٠		57.57	HMX	RDX	1,3,5-THB	1, 3-DKB	. RB	Tetryl	2, 4, 6-THT	2, 6-DNT	2,4-Di.f	CALUE DATE

NESTON PHALYTICS EXPLOSIVES

DATA BULHARY

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Note: Data is corrected for dilution,

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RFW 21-21-001/A-5/88

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RFW 21-21-001/A-5/88

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RESTON ANALYTICS REPLOSIVES

DATA BUHHARY

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| RFW Batch 31054-5-106 | Date Prepared | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Stock | Date Analyzed | Date Analyzed | Stock | Date Analyzed | Date Analyzed | Stock | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date Analyzed | Date

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Note: Data is corrected for dilution,

Connent: T-5 Post Test

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WESTON ANALYTICS BYPLOSIVES

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Note: Data is corrected for dilution,

Comment: T-5 PDST TE: F

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WEBTON ANALYTICS EXPLOSIVES

DATA BUHHARY

Units Frience Analyst Other Reviewed	
Analytical Lot Date Prepared Date Analyzed	
RFW Batch 8408 months on Installation AND AND AND AND AND AND AND AND AND AND	

Note: Data is corrected for dilution, '

Comment: TS Post TEST

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LAB ID #	0.6	626-			-	
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ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMA HAWTHORNE

SAMPLES RECEIVED: 08-01-89

RFW #: 8908L203, OIL W.O.#: 2281-08-07

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LWO2, Explosives in Soil, modified for the analysis of oil samples.

following QA/QC control samples The have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

Designates sample spiked with target compound. MS

Designates sample spiked with target compound in MSD = duplicate.

D Indicates duplicate analysis of a sample.

NS Not spiked.

DL Diluted below calibration range.

Indicates elevated detection limit due to sample G interference.

Not reported. NR

Spikes have been reported as result (% recovery). NOTE:

Data Qualifiers

Less than

Greater than

Analysis Summary:

Samples Collegued: 07-28-89 Samples Prepared: 08-04-89 Samples Analyzed: 08-10-89

Appr. 'ed By:

Géorge Perry HPLC Unit Leader

Lionville Analytical Laboratory

WESTON ANALYTICS OIL EXPLOSIVES DATA

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Ä		CLIENT:	USATHAMA-HAWTHOKNE	L	Ø A	Page: 1
	Cliei.t	PRE TS	PRE TS	PRF T-5		
Sabole	ID :	GEAR OIL	GEAR OIL	GEAR OIL		
ation	RFW#:	400	004 MS	004 MSD	BI	BLANK
	D.F.:		-4	કર્ય		~
	Units:	5,47	6/6n	6/6n	7	6/6n
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HMX	•	< 144	2610 (98.4%)	2510(50.48)	v	111
KDX	•	21306	3750(141%)	50003 (NR)	v	196
1.3.5-TNB	•	< 23.	4140(95.7%)	4180 (95.74)	,	418
1,3-DNB.	•	8.99 >	1230(130%)	1230(1908)	v	118
NITROBENZENE.	•	< 47.6	7.29 (83.0%)	729 (83.04)	v	84
TETRYL.	•	> 566	15000(144%)	15000(144%)	,	1900
2, 4, 6-TNT	•	< 217	4180(1044)	4140(104%)	V	381
2,6-DNT	•	< 45.3	800(95.8%)	800(95.84)	v	80
2,4-DNT.	•	< 47.6	R40(96.0%)	810(96.08)	v	72

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ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20 RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not specific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph. 7.

Laboratory Manager

Lichville Analytical Laboratory

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GLOSSARY OF TERMS - INORGANIC REPORTS

DATA OUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.

MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eq. MAGTO indicates an analysis for total silver).

M**50- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eq. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

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ROY F. WESTON INC. INORGANICS DATA SUMMARY REPORT 02/20/90

	USATHAMA-HAWTHORNE ER: 2281-08-02-0000	•	WESTON BATCH	F: 8908L203
SAMPLE	SITE ID	ANALYTE	RESULT UNITS	REPORTING LIMIT
-001	POST TS-FLSH CHMB WA	NITRATED ESTERS	5.0 u UG	5.0
-002	POST T2-SHIP MINE	NITRATED ESTERS	5.0 u UG	5.0
-003	PRE T5-SHIP MINE	NITRATED ESTERS	5.0 u UG	5.0
-005	PRF T5-BLANK WIPE	NITRATED ESTERS	5.0 u UG	5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	USATHAMA-HAWTHORNE ER: 2281-08-02-0000	,	WESTON	BATCH #:	8908L20:
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTII LIMIT
BLANK10	89LNC008-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC008-HB2	NITRATED ESTERS	2.5 u	MG/L	2.

INORGANICS ACCURACY REPORT 02/20/90

	IR: 2281-08-02-0000			MEZION BAT	Ln #: 89	U8L2U.
SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECI
******	*******	*======		******	*****	:
BLANK10	89LNC008-MB1	NITRATED ESTERS	10.8	2.5 u	10.0	108
BLANK20	89LNCOO8-MB2	NITRATED ESTERS	49.6	2.5 u	50.0	99
•		MITDATED CCTEDC	40 E	9 5	E0 0	00

INCRGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HAWTHORNE WORK ORDER: 2281-08-02-0000

WESTON BATCH #: £908L2

SPIKE#1 SPIKE#2 %RECOV %DIFF SITE ID SAMPLE ANALYTE BLANK20 89LNC008-MB2 99.3 NITRATED ESTERS 99.0 0.20

ROY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/20/90

WORK ORD	USATHAMA / HWAAP ER: 2281-08-02-0000	·	WESTON	BATCH #:	8908L258
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T5 FLASH CHMB WALL	NITRATED ESTERS	5.0 · u	UG	5.0
-002	T5 SMW2 POST TEST	NITRATED ESTERS	5.6	UG	5.0
-003	T-8 SMW2 POST TEST	NITRATED ESTERS	13.0	UG	5.0
-004	T-8 WIPE BLANK PRE-	NITRATED ESTERS	5.8	UG	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	USATHAMA / HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8908L25
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	891 NC010-MR2	NITRATED ESTERS	2.5 11	MG/I	2.●

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA / HWAAP WORK ORDER: 2281-08-02-0000 WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
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BLANK10	89LNCO10-MB1	NITRATED ESTERS	9.9	- 2.5 u	10.0	98.8
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA / HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8008L2

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF SAMPLE SITE ID ANALYTE BLANK20 89LNC010-MB2 NITRATED ESTERS 106 104 2.2

TEST RUN 8 400°F/36 HOURS

1311R2

RFW 21-21-001/A-5/88

WESTON		Custody Transfer Record/Lab Work Request	Recor	d/Lab W	ork Requ	lest	, KINGIM
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Work Order		Preservative	100				Delivered NOTES:
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							U.S.W.
							Sample Labels and CCC Record? Y N
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CXX SOLUCIA	WESTON Analysics	Samolas Ware:	1 Shipped or Hand	Dalivered NOTES:	2 Arrivant or Cultural	NOTES:	3 Received Broken	Leaking (improped)	Y N N NOTES:	4 Property Preserved	X >	MOLES:	Holding Time	NOTES:		COC Year	3	Package Y N		3 Present on Scripte	4 Unbroken on Burude NOTES: Y N	COC Record Was:	of Samples Y N	Discrepandes Behreen	Sample Labete and COC	-		7-116
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WESTON ANALYTICS KIPLOSIVES

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed RFW Batch STOTHURE LOIS. Installation negineral Matrix: EHISSE & WICE

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Note: Data is corrected for dilution, '

Comment: 1-9 PRE TEST

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WESTON ANALYTICS BYPLOSIVES

DATA BUEHARY

Date Prefixed The Date Analyzed Analytical Lot Hatrix: tubus vaire a San RFW Batch 9300 1000 Installation

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Analyst Sar-Revieved

Note: Dats is corrected for dilution,

Comment: -1-9 PRE 1EST

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них	2,5,0>	32700 0000		37.77	1 P P P P P P P P P P P P P P P P P P P
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WESTON ANALYTICS BIPLOSIVES

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Analytical Lot Date Prepared	Date Analyzed Sussies
RFW Batch 2908-100000	Hatrix: turente tarre tarre

Note: Data is corrected for dilution, "

Comment: 1-3 PRE JEST

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них	35,9100 05,0100	\$ 2, 9, 57		e 425	4435		Califo open		
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RFW 21-21-001/A-568

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WESTON ANALYTICS EXPLOSIVES

DATA BUHMARY

| RFW Batch '3907 HUNCASA | Analytica | Installation | Date Present | Natrix: | Electrical | Date | Analytical | Date | Analytical | Date | Analytical | Date | Analytical | Date | Analytical | Date | Analytical | Date | Analytical | Date | Analytical | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | Date | D

Analytical Lot
Date Prepared
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Units successive supervising Sources Analyst games Raviewed

Notes Data is corrected for dilution,

Conment: 7-3 Post Test

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1,3-DNB	45.90	65.90	د. ج. من د. من	K 5.900-	65.90	<5.90	< 590	15.90	£5.93	5333	5.50
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2,4,6-TNT	د. ۲۹۰۶	< 19.2	413.A	5 (A.2)	4.9.2	< 19.3	2.F12	خ ١٩.٤١	419.2	c.81>	6.9.2
2,6-DNT	44.00	4.00	44.00 × 4.00		14.00	64.00	S.7.	C 4.00	07.41	14.00	7 30
2,4-DNT	24.7C	14.23	CC. 20 016.20		< 4.30	64.30	<4.25	CE.42	14.23	1 .	14.20
- CANCE CATE	-814.	<u>६</u>	27	いわ	ris	1:1:4:) He	t 7	ध्य	ध्य	1219

WEBTON ANALYTICS BIPLOSIVES

DATA BUHMARY

Analytical Lot
Date Prepared
Date Analyzed Hatrix: RINJOIE IN PF. 4 SOIL RFW Batch 3908 HUNDERS Installation HANDTHOCKER

Units environmental production of Analyst Sam

Note: Data is corrected for dilution,

PUST TEST Comment: T.B.

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	0/0	CiÓ	7 C	215	210	ריס	810	-		1.00	1 800
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eno.T.	Ontow	6.1/an B.1/20	هي إهما	0,1,000	الإسالهدا	arilia.	ه راغدا	1.7 AV	0.41,020	12. mg	Quilan.
	25.w35	\$ \$ 1.0 - 550,05	40,03			28.7.0	J. 635	26.035	< 0.635	35.0	<0.635
RDX	40.440	054.02 054.02	40.440 40.440 40.440	20.49C	40.490	40,440	CO:410	<0.44c	בחיום בסיוים>	~0.430	40.490
1,3,5-TNB	20,12	-1.05	5617	5017 2	\$0.1. →	501-	2012	<1.05	< 1.05	-1.05	< 1.05
I, 3-DNB	40.20.5	376.02 PPE, U2	40,295	20.02	פהבים פייםים	<0.3A5	<0.375	~ 6.a95		20.295 20.295 co.295	20°50>
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2,4,6-TNT	טיזעים- מיזעיניס	-0.940	ב סיגורט	ده۲٬۵۰	61.1	~0.7LO	40.AUS	0.9400 00.940 0.940 0.940 0.940	~0.7co	<0.760	40.7k.0
2,6-DNT	co.e.co	300.0 CAIG. CO.	CO.5.0.	40.350	~0.3xc	<0.30¢	40.30c	<0.200	<0.30€	CO:20:03	0.200 0.000 00000 0000 00000 00000 00000
2,4-DNT	015.52	~0.3V3	40.310	عادد.62	CO.21.0>	CO.310	الانالات	صاحره > عادره > عادره >	CO.03	015.0> 015.0>	C0.5.0>
- DALSE CATE	7.60-	US.	218	8.4	518	स्रोह.	612	118.	श्र	3/3	313

WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed HISTICAL Matrix: Elistate Lusife & Suit NFW Batch 3908 HUNGS Installation HANTHOGGE

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Note: Data is corrected for dilution, '

Comment: T-8 Post 7EST

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Ę	(c. 3.5)	30.03 OF 20.03			3.6.7	3.6 -	015 02 3.5	315.02	20.000 20.000 20.0000 20.0000	11 11 11	
2,6-DNT 2,4-DNT On lac care	015.00 016.00	1 * 1 * 1	1 - 1 - 1		7-7-7	0.6.0-00.00.0-0-0.00.0-0.00.0-0.00.00.0-0.00.0	40.300 40.300	01502 00502-0-01602-0160	01602	ביהון מיהיסג קור 18	

WEBTON ANALYTICS EIPLOSIVES

DATA BURNARY

Installation Managerial

Analytical Lot
Date Prepared
Date Analyzed

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Note: Data is corrected for dilution, '

Comment:

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HKX		4500 50.2	T.E1>	2101	re.12	A.P. 1. 12.1		
RDX	40.49C	4.70	49.50	436	40.980	795 E		
1, 3, 5-THB	20.12	3.6	F-06-2	189 189	70.62	19.0		
1, 3-DNB	40.34f	કા:પ્ટ	27.62	· 125	524 · 641,990	5.44		
· NB	OW.0>	EUE.	C4.20	9. PC	CC+.02	4.15		
Tetryl	6.6.5	70,	c.65.0	455 AZ	c.6.0	المريد ا		
2, 4, 6-THT	40.960	7.35	<19.50	1,00	£1.92	14.0 14.0		
2,6-DNT	40.30c	→27 € 7€01	CO 177	7' ba	40.40¢	1310°		
2,4-DNT	40.210	1.89.1	05.112	الأو ا	064.02	2.4.		



RCY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20 RFW #: 3907L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

fack R. Tuschall, Ph.D.

Laboratory Manager

Lichvillo Analytical Laboratory

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GLOSSARY OF TERMS - INORGANIC REPORTS

DATA OUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prop test for ICP digastion, water matrix. MICS - Metals prep test for ICP digastion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO* This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICMTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT:	USATHAMA / HWAAP ER: 2281-08-02-0000		HESTON	BATCH #:	8908L258
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T5 FLASH CHMB WALL	NITRATED ESTERS	5.0 u	UG	5.0
-002	TS SMW2 POST TEST	NITRATED ESTERS	5.6	UG	5.0
-003	T-8 SMW2 POST TEST	NITRATED ESTERS	13.0	UG	5.0
-004	PRE @	NITRATED ESTERS	5.8	UG	5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: U	JSATHAMA / HWAAP ER: 2281-08-02-0000	•	WESTON	BATCH #:	8908L25
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTII LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2 *

INORGANICS ACCURACY REPORT U2/20/90

CLIENT: USATHAMA / HWAAP WORK ORDER: 2281-09-02-0000

WESTON BATCH #: 8908L258

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	RESULT	SPIKED AMOUNT	%RECOV
BLANK10 BLANK20	89LNC010-M31 89LNC010-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	9.9 52.9 51.8	2.5 u 2.5 u 2.5 u	50.0	98.8 106 104

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA / HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L2

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF SAMPLE SITE ID ANALYTE ------BLANK20 89LNC010-MB2 NITRATED ESTERS 106 104 2.2

ROY F. HESTON INC. INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

REPORTING

	SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	LIMIT
	-001	T-8-SM-W2 POST TEST	NITRATED ESTERS	5.3	UG	5.0
*	-002	T-8-CHAMBER WAL!W2	NITRATED ESTERS	7.5	UG	5.0
•	-003	T8-WIPE BLANK W2 POS	NITRATED ESTERS	5.0 u	UG	5.0
•	-004	T13-SM-W-2 PRE TEST	NITRATED ESTERS	12.5	UG	5.0
•	-005	T13-WIPE BLANK W2 ET	NITRATED ESTERS	5.0 น	UG	5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000			WESTON BATCH #: 8908L31		
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2

INCRGANICS ACCURACY REPORT 02/20/90

WESTON BATCH #: 8908L315

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

SP'KED INITIAL SPIKED SAMPLE SITE ID ANALYTE SAMPLE RESULT AMOUNT SARETCY 2.5 u 2.5 u 2.5 u 10.0 98.5 50.0 106 50.0 104 BLANK10 89LNC010-MB1 NITRATED ESTERS NITRATED ESTEPS 9.9 52.9 51.8 BLANK20 89LNC010-MP2 NITRATED ESTERS

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L3

SAMPLE

SITE ID

ANALYTE

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF

BLANK20

89LNC010-MB2

NITRATED ESTERS

106 104

TEST RUN 13 500°F/12 HOURS WAR STATES

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only

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DATA BUHNALY

Installation FAMINGGII Date Prepared Hatrix: Christian Library Control Date Analyzed

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E-16-16-3

30.1.02

Note: Data is corrected for dilution, "

Comments T-13 PRE TEST

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באלמר סאונ	-214.	218	21,6	418	Pig	2/5	21.3	311	1917	3/7	8:9
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DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed 3x4133 Hatrix: engine noite 1 500 いせつでいれるつとい Installation Phylickist RFW Batch

Units successions with the Son ingly Analyst Ohio

Note: Data is corrected for dilution,

Comment: 1-13 PRE TEST

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1787 C. 1.	LAB ID (TANATUR DETERMENTION BLAND	Dilution	SAMPLE VOLUME	•	st: 25		RDX	1,3,5-TNB	1,3-DIB	1 2 2 .	Tetryl	2, 4, 6-THT	2,6-DNT	2,4-DNT	- waller pare

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COLEGICAL 16-Sample Labels and COC 1 Present Upon Racelpt 4 Unbroken on Sample Discrepandes Between Leaking (Improperly 2 Unbroken on Outer 3 Present on Sample 4 Properly Preserved 2 Ambient or Chilled NOTES: 3 Received Broken WESTON Analytics 1 Present on Outer 1 Shipped or Hand-Delivered z 5 Received Within of Samples Y Holding Times COC Record Was: Package Y Samples Were: COC Tape Was: Package Sealed) NOTES: NOTES: NOTES: Use Only NOTES: Record? NOTES: Time 13 POST TEST SAMPLES Date Custody Transfer Record/Lab Work Request Received by Rem/Reason | Relinguished by 104 3 Walrix Collected 18-11-8 MING Containers/Volume ANALYSES PE Wine 18-14-87 14-89 WAS #/Type Contains: **Hefrigorators** Dele Preservative Time Matrix Special Instructions: Date TL3 Circular WI(AW) TIS Wipe Blank WI (ACN) 200 Date Rect. State Ka Neury Johnson T Dan WI (RW) Client CuniscuPhone (215) 430 1-317 HWARP Received by W3 W4 7.2 W6 W7 Client ID/Description \mathbb{Z}_{2} DS - Drum Solids DL - Drum Liquids F - Fish X - Other **5**5*R* Relinguisted by N N

-13

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W - Water

0.0H A-Air

SE - Sediment

50 - Solid

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WESTON Analytics Use Only

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Work Order

WA Use Only

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WESTERNY K-5 z 1 Piesent Upon Receipt 4 Unbroken on Sumple NOTES: Y Leaking (improperty Sealed) 3 Present on Sample 2 Unbroken on Outer 4 Properly Preserved 2 Antient or Chilled NOTES: WESTON Analytics 3 Received Broken 1 Present on Outer 1 Shipped or Hand-Delivered 2 5 Received Within Package Y COC Record Wes: of Samples Y Holding Tines Package Y Samples Were: COC Tape Was: NOTES: NOTES: Use Only NOTES: NOTES: ime Date **Custody Transfer Record/Lab Work Request** T13 Post Test Samples Received by Henvillesson | Relinquished by (Exalsives NOTALIDA ならま Cool Containers/Volume 8-111-89 18-11-5 ANALYSES FEAUESTED 8-11-81 ACN 18-14-89 18-14-8 Collected #/Type Contair.er 910 Halrigerators Preservative Time Listrix AS 3 £55 Special Instructions: 97 CP - Soil Field Bank Rinse-RI Past Ti3 PA-Field Blank RI 430-3117 Post New Contact Strate Late - No Tohnson HWARP Received by Client ID/Description D3 - Orum Solida DL - Orum Liquida **A** 经经 833 Tr. Pikeka (5/2)World 0154 THAMA World Order 22 81 - 08 Relinguished by 683 WESTON Analytics Use Only F-Fish API 8903 HWO25 Cilent Contact/Phone W-Water O-Oil A-Air 51 2/3 terr/Reason SE · Resiment BO · Selid NA Use Only 920 5.50 6.0 0 के प 1 CCC 710 נוס 410 241 015 513

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RFW 21-21-001/A-5/88

Sample Labels and COC

Recard? NOTES:

Discrepandes Between

Cust		T	fork Request	WESTON Analytice
-08-03		in Ailie I col		Samples Were: 1 Shipped or Hand- Delivered NOTES:
15 / N. Joinson	AHAI	Δ		2 Amblent or Chiled NOTES:
KI Fest Ra Post	424	× × × × × × × × × × × × × × × × × × ×		3 Received Erokent Leaking (Improperty Sealed) Y NOTES:
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Field Bhull	ACN 8-14 SI	28 X		5 Recalved Within Holding Times Y NOTES:
Da-Grum Bolida Specific Instructions: CL-Drum Uquida F-Fish X-Cater	1	13 Past Test Samples	Samples	4 Unkroken on Sesque NOTES: Y N
Becalved by D.	Date Time Hen	NemVRauson Relinguished by	Recalved by Date Time	COC Record Was: 1 Present Upon Receipt of Samples Y N
				Discrepantes Between Sample Labels und COC Record? Y N
			Land of the seco	918%

DATA BUHHARY

Date Prejared Date Analyzed Bilulea Analytical Lot Katrix: Cusase wife & Sou Installation Manageret SECULIA SOF

RFW Batch

Units RIVATE- VIETA LAPE - JOSEPH SOIL - UM Analyst Citura Reviewed

Note: Data is corrected for dilution, ?

POST TEST Comment: 1-13

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LAB ID #	-5,60	-5%0 -600	-500	- 500 - 500	- 500 - 500	- 55.0 1000	- 94.0 100	- 54 O	-360	-385- 010	035-
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SAMPLE VOLUME	į		1	1			1	1	,	,	-
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RDX	29.90	K9.65	44.80	49.80	29.65	C8.82	<9.90	c9.80	C8.8>	7-7	<9.80
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2,4-DNT	OE.4>	OE.4-2	ن د ر،۲۰	क्ट. ५०	CA. 20	OE. 4 > OE. 4 > OE. 4 >	CK. 42	04.42			OC TV
- Oxlac Date	· hila	AIIB	173	hila	6/14	Elia	TILB	HIE	− 4	4	CH

J - PRESENT, LESS THAN DETECTION LIMITS.

DATA BUHHARY

 RFW Batch SAO3HL2025
 Analytical Lot

 Installation HwwTholdat
 Date Frepared

 Matrix: Rivistr Line 1
 Solution

Units RINSGTE - LEGING LAIDE-TEAN US SOIL-1
Analyst Claim
Reviewed

Note: Data is corrected for dilution, ?

Counent: 1-13 POST TEST

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LAB ID \$	-5%0 E/O	025-	-550 014	025- 015	-5c0 016	-550 Lio	-550 018	025- 019	-5x0 0x0	-5EO	-560
SAMPLE DESCRIPTION SOIL	1-98 8	TIS FIELD BLE RINSE	7 13 PB 2			51.7 882 89	713 98 610 81X	113 991 81	7 13 181 83	T 13 RP 1 R3	713 841
Dilution	1	1	1						١	-	-
SAMPLE VOLUME	,	950	0001	CiC:01	COO)	000)	250	යගා	3001	(200)	(300)
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RDX	८०.७००	0840202602	054:0×	20.490	OH40	COHOS	364.0 > 364.0 > 364.0 > 064.0 > 084.0 > 084.0 > 084.0 > 084.0 >	OF40>	CDP4CD>	2PKO->	<0.49C
1,3,5-THB	62.09 c	دِ\.05	2017 501	K1.05	<1.05	41.05	K1.05	<1.05	<1.05 <1.05 <1.05 <1.05	<1.05	11.05
1,3-DNB	40.590	20,5940120 3PF.0> 3PF.0> 3PF.0> 3PF.0> 3PF.0> 3PF.0> 3PF.0>	3PE.0>	১০,৯৭5	20,295	3PE.02	30,245	<0,295	<0,20,5	<0,2/15 <0,2/15	<0,æ15
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2 , 4 , 6-THT	S'nL'!	1745 40.940 40.940 40.940 40.940 40.940 40.940 40.940 40.940	09V0>	201°102	0960×	09V.0>	50,94b	20,260	~0.5.C~	KO:360	C.9.C.>
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2,4-DNT	984:0>	סוביס סוביס	OK:07	CN. COX	016.02	ONE'O>	0150	OE.0>	°.Ú.≥O	०१६'७	CO. AC
ON/OC DATE	-1111	h 8	2/14	मार	alm	8,14	alia	710.	71/8	ohu	0/1110

DATA BUHHARY

Installation HSLTHORNE Date Prepared HALFIX: RINSAIE LONG 1 SOLL Date Analyzed SIIVI89

Units RINSKIE - 1163my COIPE - Fitted wg Sok- L Analyst Cypin Reviewed

Note: Data is corrected for dilution,

Comment: I-13 POST TEST

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1		44100 Ameri		 an Bulan	0> 3590>							<0.0000	co.210 co.	8 - 4/8-
MATEIL LAB ID #	SAMPLE DETORIPTION	Dilution	SAMPLE VOLLIME	UNITS	HMX	RDX	1,3,5-THB	1,3-DNB	an .	Tetryl	2, 4, 6-THT	2,6-DNT	2,4-DNT	- arlac chie



ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11.20 RFW 6: 8307L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Cack R. Tuschall, Ph.D.

Laboratory Manager

Dishville Analytical Laboratory

Date

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTINE REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.

MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. NAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXTCITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/20/90

	USATHAMA-HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8908L3
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORT:
-001	T-8-SM-W2 POST TEST	NITRATED ESTERS	5.3	UG	!
002	T-8-CHAMBER WALL-W2	NITRATED ESTERS	7.5	UG	į*
-003	T8-WIPE BLANK W2 POS	NITRATED ESTERS	5.0 u	UG	٤٢
-004	T13-SM-W-2 PRE TEST	NITRATED ESTERS	12.5	UG	į
-005	T13-WIPE BLANK W2 ET	NITRATED ESTERS	5.0 u	UG	•

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	SATHAMA-HWAAP R: 2281-08-02-0000	· .	WESTON	BATCH #:	8908L315
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 WESTON BATCH #: 8908L

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%R
******	**************	**************		*****		==
BLANK10	89LNC010-MB1	NITRATED ESTERS	9.9	ى 2.5	10.0	
BLANK20	89LNC010-MB2	NITRATED ESTERS	52.9	2.5 u	50.0	1
		NITRATED ESTERS	51.8	2.5 u	50.0	1.

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INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L315

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF SAMPLE SITE ID ANALYTE BLANK20 89LNC010-MB2 104 2.2 NITRATED ESTERS 106

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT C2/20/90

	USATHAMA-HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8908L3
SAMPLE -001	SITE ID POST T13 SM WS (ETOH	ANALYTE NITRATED ESTERS	RESULT 5.0 u	UNITS	REPORT
-902	POST TISFC CH WAL W2	NITRATED ESTERS	5.0 u	UG	•
-003	POST T13 WIPE BL W2	NITHATED ESTERS	7.5	UG	i <u>.</u> ≜
-004	PRE T14 SMW2 (ETOH)	NITRATED ESTERS	5.0 u	UG	!_
-005	PRE T14 WIPE BL W2	NITRATED ESTERS	5.0 u	UG	• ! ,

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 **WESTON BATCH #: 8908L398**

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	LIMIT
BLANK10	89LNC010-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC010-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC. INORGANICS ACCURACY REPORT 02/20/90

CLIEN	AZU : IV	IHAMA-HWAAP
WORK	ORDER:	2281-08-02-0000

WESTON BATCH #: 8908LT

SAMPLE	SITE ID	ANALYTE	SAMPLE	RESULT	SPIKED	%RI
BLANK10 BLANK20	89LNC010-MB1 89LNC010-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	9.9 52.9 51.8	2.5 u 2.5 u 2.5 u	10.0 50.0 50.0	

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L398

		and the second s	OF INET	1 3517549	
SAMPLE !	SITE ID	ANALYTE	%RECOV	%RECOV	%DIFF
		第三六元章以前中国共和国的政治等300万万万	***		化物学医疗物
BLANK20 8	B9LNCO10-MB2	NITRATED ESTERS	106	104	2.2

TEST RUN 14 400°F/12 HOURS

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213 17.5 20 210 Ketrix: 3 - Soll

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1,1,c,h,1/4,2/2, 3-14-2-7	1 Present Upon Receipt of Samples Y N
	Discrepancies Butween Sample Labeis and COC
	Record? Y N
RFW 21-21-001/A-5/66	

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WESTON An	WESTON Analytics Use Only CUSTOD	y Transfer	Record/Lab	ody Transfer Record/Lab Work Request	, KLEYELLA
\$308 HLX234	ריי המכאיי	Refrigerators			WESTON Analytica
15B	SATHAMA / HWAAP	inar	VOA Ander		Use Orife
ş	-20	Containers/Volu.ne	500 P	-	Samples Ware:
Deste Roc'd.	Date Due	Presurvative	Cast col		Delverad
CHANT CONTACT PROPERTY	Phono (215) 430 -3117	ANALYSES PER PECUESTED	Ser Servi		2 Amblent or Cliffod
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RFW 21-21-001/A-5/36	524				

WESTO	WESTON Analytics Use Only	Custod	ody Transfer Record/Lab Work Request	r Reco	ord/Lab	Work R	sanbə	فبيق	WARNERS 3
	Company of	9	Reiriperators						WESTON Analytics
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DATA BUINARY

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Conment: T-14 PRE TEST

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Notes Data is corrected for milution, "

Comment: 1-14 PRE TEST

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DATA BUHLARY

Heriation Hamingers Date Hatrix: Subart Land

Analytical Lot
Date Prepared
Date Analyzed Eliules

Units RINJITE-11972 WIFE : TIEL IN TOIL - Units
Analyst Calm
Reviewed

Notes Data is corrected for dilution, '

Comment:

MATKIN	ď	Z	3	3	٠,	· •
LAB ID	BLANK	104	BLANK	101	BLANK 10x	
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них	\$69.0>	S.83.	עביוש באון ניצוש בפים	אים וויין	1	7.50
RDX	COHOS	79, 6,7	C 9.80	99.3 E	-0.4BO	
1, 3, 5-TNB	41.05	1.7	P.06.2		F.C. 4.2	J
1,3-DNB	co.275	13.	6.5.90	57.3	57.3 · 6.63	1
N. C.	الة. ن	727-	417 FO.E	42.84	OE N 07	J
Tetryl	ک,ت >	1746 2.55	50.0	70,	65.0	JL
2, 4, 6-TNT	20,960	1 <i>3</i>	E.912	10°		5.51
2,6-DNT	<0.30C	7,501	64.00	43.5	40.426	71.21
2,4-DNT	615,02	1,945	06.Y2	منه ح.00	מצאיניס	,

z Sumple Labels and COC 1 Present Upon Receive 4 Unbroken on Sample NOTES: Y **Disaspandas Botween** WI CORRECT 3 Prescut on Sanpie Lauking (improperty 2 Unbroken on Outer 4 Froperly Pressived 2 Ambient or Chiled NOTES: 3 Received Broken 1 Present on Outer WESTON Analytics 1 Shipped or Hand-Delivered z 5 Received Within of Samples Y COC Record Was: Holding Times Package Y Sangles Were: COC Tape Was: Package Seuled) Record? NOTES: NOTES: NOTES: NOTES: Usa Only Time 14 Past Test Samples. Date Custody Transfer Record/Lab Work Request Received by Helinguished by A party Ya/ ltem/Resson 25 Wipe Blank WIRIWPER-18-591X W. pe 18-18-84 ANALYSES REPREDING X-19-59 Containers/Volume WIR 8-18-8 Collected #/Type Container 950 Reirigerators Preservative Time Mutrix 14106 Special Instructions: 88 Date ACN 1200 れつつ ACN Ka N Johnsen (3/5) 430 - 3117 Received by HWARP weals WI Client ID/Description X43 Q M **M**5 K M <u>`</u> × DS - Drum Solids DL - Drum Liquids F - Fish X - Other トロペーのイ Z Tr. Saluto <.5R Ralingulehed by WESTON Analytics Use Only Stor Hugge ビ Date Rec'd. Stude Kra. SM CILLUS LISATHAMA Work Order 3381 Client Contact/Phone _ W-Waxe 0-00 A-Ar TIH I TIT. T tenvilles son SE - Sediment SO - Solid WA Use Only 900 CO3 500 800 603 Oic 100 004 000 00.1 3 Q ä

Leaking (improperty Package Y 3 Presunt on Sample 4 Properly Freserved 2 Unbroken on Outer 2 Anklant or Culted NOTES: WESTON Anayace 3 Received Broken 1 Silpped or Hand-Bullyward 1 Present on Outer z 5 Received Within Hidding Times Pachage Y Sanglas Vlars: COC Tape Was: Seided) NOTES: Use Oak NOTES: NOTES: NOTES: Custody Transfer Record/Lab Work Request A Le 200C an an Containers/Volume Matrix Date Collected **张光**别 ANALYSES THE REQUESTED ACN 8-18-89 ALN 15-18-39 18-8 #/Type Conteiner Refrigerators Preservetive KN 33 Ś 14 CP Enild Blank Rinse AFW Conject State Control Of State Of S TH PBI FIND BROOK RI HWARP Client ID/Description Work Order 338/-08-0 8 6 6 2000 2000 2001 2001 360WH80P8 WESTON Analysics Use Only Client USATHAMA

714 PB

110 210 910 017

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VA Use O.Y

SE-Sedment A-Air SO-Selid	0 - Cil DL - Drum Liquida A - Air F - Fish X - Cither	Liquida	1	1/1	1 Pas	TH Past Test Samples	Sampl	5	+ Undroken on Sample NOTES: Y N
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	11/0/1/1/		15						> 2000
		7	17 1/11						
									Discrepshides Bennesh
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4 Unbroken on Sample NOTES: Y

Special Instructions:

DS - Drum Solids DL - Orum Liquida F - Fish

W - Water O - Oil A - Alr

10 To 10 To

02/ 033

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RFW 21-2: -001/A-5/88

RFW 21-21-001/A-5/86

DATA BURNARY

RFW Batch 8968 HW 626-Installation HAW FHORNE Natrix: Ringul, wipe, 9 Soil

Analytical Lot
Date Prepared
Date Analyzed

Units Rinself using unp linkship, cfill ufly Analyst Als Als

Note: Data is corrected for dilution, '

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COMMENT.			1								
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LAB ID #	- 100	-) C 8 C 8 D 7	-963 -363	-9co-	5.30 -903	500°	C.36 ·	300 300	სა მ - პო	C.2G- 61C	C 76 - 1
Sumple Descripter wi upper	THE SERIE	THESHIT	בואלה גינאו און אנינון	(T)	FINSORI THE SONI THE SONI	Ted Scrib	1214 55 MIT	714 #111	TIN 3M	W. ACN WAY WAY HEAR YOU	Hrak Year
Dilution	-			-	-				-	-	-
Sample vel (md)	!	1			,	-	ï	1		,	
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нмх	38.3	412.7	(12.7	419.7	4.2.7	43.7	419.7	T.E13	412.7	T:61>	412.7
RDX	40.6	41.4	40.8	\$ W	4.65	8-65	3.67	-5-6>	.\$.6>	\$11.5	4.9.9
1, 3, 5-TNB	aral	426.9	6.36.3	رعو ٩	43c 9	b ን ር ን	b ማሪን	6.05.5	しってつ	6065	436.9
1, 3-DNB	45.m	W.5>	b8·3>	45.84	68:57	65.5.>	14.57	12.57	18.57	153.55	68.53
SN .	44.14	44.19	61.42	44.FG	61.4>	44.19	61.U>	44.19	しいカラ	791.42	61.4>
Tetryl	3.0€>	456.0	2.35>	o.8)	6.057	5500	0.25>	0.35>	7.5.c	2.25.5	20 as>
Z, 4, 6-'fnt	2.11.2	∠19.2	419.2	(M.3	ζι ς. 2	419.2	ج.61>	6.91>	419.2	۲.69.۶	4.69.2
2, 6-DNT	44.0	64.0	3. 1 2.	2.4.5	ς4.c	0.H>	ዕ.ኯን	o·h>	٥٠٣٧	3.77	0.77
2,4-DNT	< 4.20	<4.2c	מביאץ	24.3c	(4.2c	ĊΨ.2C	oc.h>	24.3c	לאישכ	24.3C	14.20
Oxlee Date	31/3-	818	sila	31/3	8118	31/3	816	8-18	الله	واد	ايد ان

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DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed

Units Resent whe this of the Trib of the Malyst Analyst Analyst

Note: Data is corrected for dilution, '

RFW Batch 9909 HW COE-Installation 4400THERNIE Matrix: Ringulf, Wilph, E SEIL

T-14 Past tast Dumples Commert:

MATRIX	v	¢	æ	22	Œ	œ	Œ	Ø	2	α	¤
IAB ID #	6.36- C13	6.56	1000	-3c0 -3c0	636~ 616	636-	026- c18	619	- 9C3 - 9C3	-360 120	-903
Sample Descrip	T14 CP	Tity CP Field Bik	T14 PB1	राम् ल्खा स्ट	त्तास १७। स्त्र	TH PUI	Tid PBI Field Blk	Tilf Spi	ग्प क्या प्रय	Tiy Spi	Tid spi
Dilution	*	-	-	1	-			1	1	-	-
Sample Vel/wit	1 g/m	mase	10cc m	1000 14	Pr 2221	1CCE m	pu 25°C	10,000	الحدد س	KCC 111	ادرد س
					-						
પ્રભાઉ	usg	the my	45 ml	ut m	1m 3m	מנלשין	اسا قبند	145 m	当	141 St	nic [wy
жн	41.27	(6.C3S	₹9.0}	\$63.0)	\$63.3	(6.635)	(0.635	3693)	(0 (35	\$E7:3>	<c.6.35< th=""></c.6.35<>
RDX	86.0)	64.0>	(c.49	64.03	P4.3>	6th 03	Pt.3>	6th 07	bh o'	6. 49	bh >>
1, 3, 5-TNB	(રાદ૧	501>	(1.05	<1.es	591)	50:17	41.05	(1.es	4.05	53.15	\$3.15
1, 3-DHB	५८ ० इस्त	<0.295	इफ्ट ०)	(c 295 .	र्ट अंड	<6.295	sbr.o>	<6.295	خد:عاد	5bC 2}	SIX 3>
. KB	(c.419	اد.6)	(c.3)	10.0)	(6.21	(c 2)	16.07	(c 3)	1c 0>	4¢ 31	(c.3)
Tetryl	65.6	(3.5	(3.5	(1.5	(3.5	(2.5	53.5	43.5	5.63	(3.5	42.8
2, 4, 6-THT	4192	७७ ३५	36.95	4096	96.3>	96 a>	(د داد.	, pe 3>	36·0>	915.07	36.05
2,6-DNT	h o>	<0.20	ره٠عد ((b.3c	⟨¢.3¢	לר שר	(د عه	SC-35	€0.3C	25.35	or 97
2,4-DNT	دې.۵۶	(c.2)	(6.31	16.27	12.0>	(c.3)	12.37	וני סץ	16.02	1C 27	(c 3)
-Chiec Date	· 20 12 -	عااه	.2115	21/3	81 0	2 1 &	21/3	216		4115	31/2

DATA BUNDARY

Analytical Lot
Date Prepared
Date Analyzed RFW Batch Stiff Hill 626-Installation HALTFICANE Hatrix: Ringely, Wipp, 8 Sell

Units Rinside us ml, usinge-Tensing, coll ms of Analyst +115

Note: Data is corrected for dilution, '

C. Samples Comment: Tit fost Test

13	1-963	Fred BIK	-	ase ad		145 m	<0.6.35	bh:9>	41.CS	८० जाड	45.210	(3.5)	20.0>	46.36	וצ פא	خالف
ان) C0	TIT SHELL	-	3cm	-	W. 18	0.481	2.9 Co.49	\$3.17	Slor of	40.210	(3.5	11.37	०८ ०>	0.25	31/3
Ø	- 9ea	THE ART THE FIRE BIK		3cc m		Life my	+031	1.65	1.23	SIC 0>	לב.שום	<3.5>	17.04	٥٤.٥>	O. West	81/3
R		TIN SHRI	-	3x nJ		45 [m]	2.40	22.9	2.24.5	\$0€.3¢	رد عه	43.5	10.80	26.35	0.393 0.4651 0.25 7 40 21	S118
ø	-970	T14 54108	-	fu me		m3(m)	त्र.एम है	21.9 1	2.33 (2	(0.29s	40° 316	<2.5	17.34	40.3e	0.36.1	2 31/5
MATRIX	I'VB ID #	Sample Bescriphe.	Dilution	Sample uti/ut		Anik	них	RDX	1,3,5-THB	1, 3-DNB	NB.	Tetryl	2, 4, 6-THT	2,6-DNT	2, 4-DNT	المراهد عماد



ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20 RFW #: 8907L058,059,154 8908L2(3,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

dck R. Tuschall, Ph.D.

poratory Manager

Denville Analytical Laboratory

DATE

GLOSSARY OF TERMS - INORGANIC REPORTS

PATA OUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABEREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.

MICS - Metals prep test for ICP digestion, soil matrix.

H**TO- This type of code indicates a total metal analysis
(ag. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. NAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC. INORGANICS DATA SUMMARY REPORT 02/20/90

WESTON BATCH #: 8908L398 CLIENT: USATHAMA-HWAAP WCRK ORDER: 2281-08-02-0000 REPORTING SITE ID UNITS LIMIT SAMPLE ANALYTE RESULT -001 POST T13 SM WS (ETOH NITRATED ESTERS 5.0 u UG 5.0 -002 POST T13FC CH WAL W2 NITRATED ESTERS 5.0 u UG 5.0 -003 7.5 POST T13 WIPE BL W2 NITRATED ESTERS UG 5.0 -004 PRE T14 SMV2 (ETOH) NITRATED ESTERS 5.0 UG 5.0 -005 PRE T14 WIPE BL W2 NITRATED ESTERS 5.0 5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

2.5 u MG/L

CLIENT: USATHAMA-HWAAP
WORK ORDER: 2281-08-02-0000

SAMPLE SITE ID ANALYTE RESULT UNITS LIMIT

BLANKIO 89LNC010-MB1 NITRATED ESTERS 2.5 u MG/L 2

NITRATED ESTERS

BLANK20 89LNC010-MB2

INORGANICS ACCURACY REPORT 02/20/90

	ISATHAMA-HWAAP R: 2281-08-02-0000			WESTON BAT	CH #. 89	08L398
SAMPLE BLANK10 BLANK20	SITE ID 89LNC010-MB1 89LNC010-MB2	ANALYTE NITRATED ESTERS NITRATED ESTERS	SPIKED SAMPLE 9.9 52.9	INITIAL RESULT 2.5 u 2.5 u		%RECOV 98.8 106
		NITRATED ESTERS	51.8	2.5 u	50.0	104

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HYAAP WORK ORDER: 2281-08-G2-0000

SAMPLE

WESTON BATCH #: 8908L3

SITE ID

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF

106

8LANK20 89LNC010-MB2

NITRATED ESTERS

ANALYTE

104 2.2

ROY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/20/90

	: USATHAMA-HWAAP RDER: 2291-08-02-0000	•	ME210M	BAICH #:	89081402
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T14 SM W2 ETOH (POST	NITRATED ESTERS	5.0 u	UG	5.0
-002	T14 FC WALLS W2 ETOH	NITRATED ESTERS	20.3	UG	5.0
-003	T14 POST WIPE BLANK	NITRATED ESTERS	5.0 u	UG	5.0
-004	T15 PRE SM W2 ETOH	NITRATED ESTERS	6.6	UG	5.0
-005	T15 PRE WIPE BLANK	NITRATED ESTERS	5.0 u	UG	5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	SATHAMA-HWAAP R: 2281-08-02-0000			WEST	ON	BATCH #:	8908L4
SAMPLE	SITE ID	ANALYTE	,	RESULT		UNITS	REPORT LIMIT
BLANK10	89LNC012-MB1	NITRATED	ESTERS	2.5		MG/L	
SLANK20	89LNC012-MB2	NITRATED	ESTERS	2.5	u	MG/L	

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORUER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SPIKE#1 SPIKE#2 %RECOV %DIFF SAMPLE SITE ID ANALYTE BLANK20 95.2 97.6 2.5 89LNC012-MB2 NITRATED ESTERS

INORGANICS ACCURACY REPORT 02/20/90

	JSATHAMA-HWAAP ER: 2281-08-02-0000			WESTON BAT	CH #: 390)8L·
SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RI
BLANKIO BLANK20	89LNC012-MB1 89LNC012-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	10.1 47.6 48.8	2.5 u 2.5 u 2.5 u	10.0 50.0	1(

TEST RUN 15 600°F/12 HOURS

1311R2

Custody Transfer Record/Lab Work Request

WESTON Analytics Use Only

RFW 21-21-001/A-5/88

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Sample Labels and COC Record? Y N

NOTES:

Discrepandes Balween

r S

	WESTON	raly	y Transfer	Rec	ord/Lab W	Custody Transfer Record/Lab Work Request	sst	WASSING !
	8908	8908HW037	Refrigeratora					WESTON Analytics
	>11		#/Type Container	VEALAND	4mb2			Samples Were:
	Cient - Add	Client CO - CO - CO - CO - CO - CO - CO - CO	Containers/Yolume		40m			1 Shipped or Hand-
	Work Order		Preservative	123				Delivered NOTES:
	RFW Contact SQLQL	RFW COMEST SOLCKO N. TEMSON Client Contect/Phone (215) 730 -3117	ANALYSES PER PREQUESTED	方	7.16			2 Amblant or Chiled NOTES:
	WA Use Only	Cilent ID/Description	Matrix Date Collected					3 Received Brokery
<u> </u>	910	TIS SSRA WE LOWER	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	X				Leaking (Improperty Sealod)
10	C 72.25	TIS SM WI AW	Mio2 8-21 -89	×				Y N NOTES:
910		Blank Wi ACN	WiR Raish	X				4 Properly Preserved
9	1000	T15 (10 Spi)	Soil 8-21-84		 			Y N N N NOTES:
			l D					5 Ruceived Within
Q S	C3C	TIS OF FIRTH Blank KINSE	ACN 8-31-84		A			Holding Times Y
90	16.3	TIS PBI RI	ACV Y-ZIBY		×			NOTES:
	973	ŔŽ			*			COC Tape Was:
	623	K3			1			1 Present on Outer Package Y N
		A	A.					2 Unbroken on Outer Package Y N
								3 Present on Sample
	Metrix: 8 - Solf 8E - Sediment 8O - Sulid	W - Water DS - Drum Solide Special instructions: O - Oil DL - Drum Liquids A - Air F - Fish X - Other	1	7	Test	TIS PRETEST Samples		ep.
	ltem/Resson	Relinquished by	e Time Herr/Reason	BSOR	Relinauished by	Received by	Date Time	COC Record Was: 1 Present Upon Receipt of Samples Y
		7. 1. Jackta 01211	27					ndes Between Labels and CO
								Record? Y N NOTES:
				1				

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RFW 21-21-001/A-5/88

WARREN D 1 Present Upon Receipt 4 Unbroken on Sample NOTES: Y Leaking (Kripicperity 3 Present on Sample 2 Unbroken on Outer Package Y 4 Properly Preserved 2 Ambient or Chilled NOTES: WESTON Analytics 3 Received Broken 1 Present on Outar 1 Shipped or Hand-Delivered z 5 Received Within of Samples Y Hooing Dmes COC Record Was: Package Y Samples Were: COC Tape Was: Sealed) NOTES: NOTES: Use Only NOTES: NOTES: Time Date **Custody Transfer Record/Lab Work Request** TIS Pre Test Samples Peceived by Item/Reason | Relinguished by Exolisi Veo ? ,% が対 3 715 SSR1 Solke Rinap AW 8 M189 X 115 55R & Soike Ringal AN 8121184 |X Collected S/21/39 TIS APA SPIKE RINSCHE ACNIBIZING Containers/Yolume AN 8/21/89 TIS API Spike Rinsafe AN BIZIKA ANALYSES PEROUESTED #/Type Container Date Refrigerators Preservative Time Maturix ACN Special Instructions: Date Riv Contact Salar Kul Ali Johnson Cilont Contact Plans (2157 430-3117 PA Field BRAKK WAAP Received by Client ID/Description **E33** RH DS - Drum Solids DL - Drum Liquids F - Flah PBA Relinguished by 2 - OB WESTON Analytics Use Oral 750WH80P8 Work Order 23.81 W - Waler O - Cil A - Air 75 Item/Reeson WA Use Only 550

760

SEC OSE 340 C32

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Sample Labels and COC Record? Y N

Record?

NOTES:

RFW 21-21-001/A-5/88

Discrepancies Between

DATA BUHMARY

5010 13 130 110 S Analytical Lot
Date Prepared
Date Analyzed Installation MACENTALE NOT HATELEX: Engale 12/20 8 3011

Units Riverell action, when here here in mily Analyst - wife sevies

Note: Data is corrected for dilution,

Comment: T 15 Pre Leet Sample.

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I'VB ID (103.7 101.9cc4	C.J.7 Cristation	6134-623	613 4616	21.6.2.7 17.0.2.7	F.0 /-	- 6 . G	C37	263-	46.2 T = 16.3	C377-
Carng's Exercipien T 15 \$581	T 15 \$581	100 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Tis sens	115 55K1 1455 7449 1455 7449	10 20 20 1 1 2 20 20 20 20 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	דוש הוא יאו אנים	T 15 with	T15 cp	7.15 CF	דינה קטו בו אין	Tis Fig. Ri. R.
Dilution		1	4	1	21			120,666	-	_	-
Snorp's Vellifit		1		•	1	1		1.003	35cm	27.00 3.00 3.00 3.00 3.00 3.00 3.00 3.00	1111
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130:12	fred us.	 Len 45.	J. 14.4	forks suy.	totis wer	المرادين	Ju 6.5.3.	الري ج	lic on	Tu ha	<u>}</u>
них	412.7	£:01>	36.51	\	596.1	60.7	(10.7	41275806	\$6.03	SE3 97	₹6.6.35
RDX	رنا .هـ	3.05	41.e		Sonte	5.10>	3.65	المنهديدر	. ሁከ:0ን	6th 3>	6113
1,3,5-TNB	h-36>	৮ ৩৫>	1)·067	الاين		6.35.5	७ ३८)	לאמערנים	(1.0%	571)	5917
1,3-DNB	હિકો	હ્યું કર	45.89	(5 دوا .		3.7c J	b3 57	Jposb55	₹6.39¢	الا تعراق	C. 245
an .	br hን	61.4>	61.117	P1.45		TEI	61.43	לחושכנם	אר טיר טי	رد. عاد	לני שור
Tetryl	a-33)	4.25.4	3.25)	450.0		(که د	0.1;1	********	5.0	5 t'>	(3.5)
2, 4, 6-Tht	£ 4.3	F.45.91	10.1 TH 93 63	43 67	\	1: 501	10.1 F	657ccó 9	20.0>	D.432	76.95
2,6-DNT	(ij.o	a-h7	4. to	O.4.		ر اد .د.	2.4.7	לווכבנינו) (c _, c _,	oc 2)	30.30
2,4-DNT	64.3	2 h)	2મના	3.3 J		19.61	2.4.2	לחזיינטנ	(6.3)	10 37	10 37
- ومدرلاد الماد	1015-	tc/s	10/3	16.13	10%	تدأع	10)2	10/2	ن ا د ا	10/13	10/20
(10%)							٠.				

DATA SUHHARY

Analytical Lot
Date Prepared
Date Analyzed

Installation MANGENCE PROE

State (13) 29

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Note: Data is corrected for dilution,

TIG Pre Test CORDEDT:

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IAB ID #		-Les	C.A.C.	C.37	C.3.7	637	- L-C-2	7:3	C37	637-	-25.3
The Ind	The fill	11.00	18. Ap. 18. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	Copies Act	Tis Alt	19 55 W	716 2563 2016 2016	1 2 2 197	102 25 12 1 14 12 12 12 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15	The Astronomy	1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A
Dilution	-	-	16.0	2	J			100	-	231	-
Sample Willwit	2564	mase.	14025.	25.cm	Ju zic	EC n.	Se 18	Ju 25	20.00 m	Jr. 1.5	20.00
. Initi-	in jest	لس)زيد	ساكن	7w j√	اساتيا	در) درین	ولاأك	12/1/14	r jod	~	1 2 2 2 2
	25:30)	76.G3F		Ś€·3>		36.53					2000
RDX	υh: ο>	C.463		0.963		3.903					3.43
1, 3, 5-TNB	\$315	0.13 J		507		C.975J					D.85.0
1, 3-DNB	306.33	20.3015		(3.9E.		٥. عراكر					C.33 P
KB	جزوريان	40.310		(3.10		16.33					(6.3)
Tetryl	\$1E>	5.57	\	Sc>	\	υ ()					Ses
1,4,6-TNT	دوريو		12257		1.2500	\	:05801		9000		1
2,6-DHT	\$635	De 3)		3.6		1. ?		1			-10.00
2,4-DNT	13.33	1.98		3.25				15.0		19.5	
ביין מים יצייות	1. 1.15-	15/5	10/5	16/5	18/5	10/5	10/2	16/2	10/3		161
(11501)											

Sample Labels and COC 1 Present Upon Receipt 4 Unbroken on Sample NOTES: Y Discrepandes Between Leaking (Improperly Packegs Y 2 Unbroken on Outer 3 Present on Sample 4 Properly Preserved 2 Ambient or Chilled NOTES: WESTON Analytics Received Brokery 1 Present on Outer 1 Shipped or Hand-Delivered Z 5 Received Wilhin of Samples Y Holding Times COC Record Was: Samples Were: COC Tape Was: Package Sealed) NOTES: NOTES: Use Only NOTES: NO FES: Record? E S Date Custody Transfer Record/Lab Work Request POST TEST SAMPLES Received by Relinguished by 100°F/12 hes \$\overline{\pi_{\alpha}}{\overline{\pi_{\alpha}}} Ved 2.5. × Ch **Nem/Reason** ANALYSES ** AQ 18/27/8 7.13 Containe: s/Volume WA 8/139 Date Collected #/Type Container Preservative Time Matrix Special instructions: Data ल्ड हा Past Test Blank Bate Hac 4. Johnson, M. MAZE Jan WB Bottom W 7 Rotted Received by **E**TOH 15 Total TISSSE FIELD Blonk HWARP 707 107 79 Client ID/Description 107 Dt. - Drum Liquids DS - Drum Solids 4 **9** 74. A FIELL Work Order 2281-09-02 TIS API RI Relinguished by WESTON Analytics Use Only - PEO-WH 25178 F. F.S. X.OFX TIS 55R1 USATHAMA 15 552 115 35R TIS 55R 15 55K 1 115 55R 75 SSE 15 55R Cilent Contact/Phone 115 A.A. 9.0 Date Rec'd. Item/Reason SE - Sediment \$0 - Solid WA Use Only 1 2500 800 603 010 6 710 De-T 600 010 - NOV. SCS coB なのか <u>-</u>8 00 3

EXP = EXPLOSIVES

RFW 21-21-061/A-5/88

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NOTES:

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RFW 21-21-001/A-5/88

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RFW 21-21-001/A-5/88

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LYTHUSE K	WESTON Analytics	Samples Were:	1 Shipped or Hand.	NOTES:	2 Ambient & Chilled NOTES:	3 Received Broken/	Leaking (improperly	Z Comp	NOTES:	4 Properly Preserved	NOTES:	ceived vuin dding Times	NOTES:	COC Tabe Was:	15	Package Y N	Package Y N	3 Present on Sample	4 Unbroken on Sample NOTES: 7 N	COC Record Was: 1 Present Upon Receipt of Samples Y	Diogenandes Beimeen	Sample Labels and COC	Record? Y N	NOIES:
WESTTON ARIAPPICE Use Only Custody Transfer Record/Lab Work Request	Rufrigerator#	Thursday	Containers/Volume	Preservative	HFW Contact N. TOBALSC N. M. MAZCLOTA ANALYSES . A. S. Client CuntacyPhone REQUESTED	Client ID/Description Mairix Date Collected	TIS SM W/1 POST-TROST WINE 10/27/89 X	BIWITE		~ 1	1011 Sec 1107								W. Water BS. Drum Liquids Special Instructions: 7-15 BST TEST SAMPLES	n Relinquished by Received by Date Time Hem/Reason Relinquished by Recuived by Date Time				
WESTON		11/2	Citate C	Work Order	RFW Contact N. 70	WA Use Only	027	350	7	\exists	250								Matrix: 6 - Soil	Item/Resson				

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed RFW Batch (44/0e 5/27/59 Installation HAWTHCHNE HATTIX: RINSOLT, WIDE, SEIL

P3/76/2

Units Rinsoli using wife land up, sail suly Analyst Reviewed

Note: Data is corrected for dilution, "

Part test Sample / Oc. Comment: T 15

					 شقه خارش									
					 		·							
	ادي ا				 3. S.	(0:5p	14. 48 14. 41. 81. 81. 81. 81. 81. 81. 81. 81. 81. 8	75.73	13.57	. 1/1:45		78.53	1/110	Sc. 1.
N	Hank)		S S	75.15	& 0)	42.09	(0.5 kg 5.2	(e.419 37	0:5}	h51)	96 04.05	1000
, c)	Wipe 1 167 Brak Wipe		1		 - htaling tetal usp	1,001 Les 7. 613	(c.16 8:85)	(30.9) (89.05)	(C.84 52.6	0.8E 61.1.	(thn 205)	13-18 (SI C.b)	13.60 S.TE O.H.>.	7985
Ŗ	10 t Rinselt				 Mg La	> se 9	79	7,	101	1 7 6	7.6.35	1/2.8	h,8:36	1/2 1/4
Ä	Rinsche				 5.0 m	469 0>	P4.3>	(1.05	sbe: 0>	010.0>	5.65	₹0.9£	oc.0>	160)
MATRIX	LAB ID 4	•	Dilution	•	Units	НИХ	RDX	1,3,5-THB	1,3-DNB	NB.	Tetryl	2, 4, 6-THT	2,6-DNT	2,4-DHT

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed
Sparing Clarker RFW Batch 5968 HW-039-Installation HAGTHERNE Hatrix: Rivedt, Wift, 9011

Note: Data is corrected for dilution, '

Feist Past Samples. 151 Connent:

				7			- N			1	1		1	-	1-	1
ø	30	TIS AP	_	1000	4460 4460	m.) 5551	<0.63S	64.07	50:17	(c.295	८६.३१०	5.67	40.95	6:05	(0.2)	(6)3
ø	- 620 010	T 15 -121	~	(aco m)		melm	₹6.€3¢	64.03	4105	20.29s	(0.210	5.67	40.96	40.20	⟨c.2	12/8
3	- }	TIS SSK Field Byk	-	ı		المنا لتاعا	K12.7	£3.63	\$.00\$	68.2>	51.42	2.05.5	3.8 4.9	6.4.0	44.7	Lels
3	C.29 80.87	TIS SEL	-	ŧ		मिटियार निध्य सर	T:C1>	رع. هر ج. ه	(20.9	12.5>	44.19	3.02>	2.3 5 2.3 5.	0.77	. E h1	ાલક
3	\$ 8	TISSER!	-		and the second		(12.7	43.8	4.90.9	45.89	K4.19	6.05	2.9 57	0.27	1.4 5.1	17/3
R	-500	TIS SSRI MG. PRIF				किंद भीन किली मह किंदी पर दिन्दी भा	T.C1>	(9.8	420.9	\$8.5>	61.4>	6.08>	E S. C.	6.47	1.43	برواء
3	भूत १९९	1.55 2517. 1.58 26.1	-	1		Jelal mg	(10.7	8.6>	420.5	pa.25	P. P.	6.00	6.6 3	0.47	1.33	100
3	\$ 13	TIS SERI LAG TOP	-			- Pr 174	12.7	4.8>	4,269	(S.89.	64.19	0 &>	1.87	0.47	4.42	الح)
3	- 480	15558 W3 Tap	-	1		करत धर्	(12.7	ક.ף	Poc>	b5·5>	(4·P	0.69.	1.4 J	64.0	t-h>	Lc)8
3	- 803 - 803	TIS 5581	-			रेज शिक्ष	L·cI>	<i>\$</i> '6>	420.9	68.87	61.4)	0.05)	ES.3	0.4>	1.3	Mrc43
3	-bc3	TASTER!	-	1		totel ut	419.7	४-५२	4369	18:57	M.43	<.80.0	4.83	0.45	1.35	148-
W.KT.R.	LAB ID #	Sumple Becription List Top	Dilution	(mls) Scumple veli /wt	•	Unite	нж	RDX	1,3,5-TNB	1, 3-DNB	an .	Tetryl	2,4,6-THT	2,6-DNT	2,4-DNT	- 64/6c : DOLC

Sullay I seight the State

DATA SUMMARY

| Analytical Lot | SqCP | 140-029 - | Analytical Lot | Installation | 1400 - 160 | Spil | Date Analyzed | Spil | Date | Analyzed | Spil | Spil | Date | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil | Spil

Notes Data is corrected for dilution,

connent: Tis Post Tast Samples

Connent:	21	1001									
MARRIX	R	R	צם	R.	×	α	×	8	R	ď	૯
LAL ID	-peo	-900	- 6.0	- 600	510	PC0 .	180	- bca	9.50 9.50	PG 2	6:00
Comote December	=	TISAPI	TIS AF	T-15 PB)	IBA PRI	60	Tis Pai	T IS PB	72	TIG- SHR!	TIS SHED
Dilution	1		-	-	-	2 -	-				· -
Sumple Vel: Jest	1000g	lecon	J. O. D.	[EC.D.M	160021	(Moon)	16COM	mase	3com	3000	Beend .
units	145 m	135 m	148 [m]	46 (m)	145 [24]	WEP IN	12 Jan	Jus [my	M5 Fm	Palsa	pa]5a
XHII	(6.63	Se9.0>	SE9.0>	\$69.0>	<6.63S	40635	4c.c35	<0.035	₹903≥	\$6.635	406.55
RDX	₩ 9	40.49	64.03	84.02	12 to 44	KC-44	47.07	4.07	60.49	८०.पव	64.07
1, 3, 5-TNB	<. cs	41.05	41.05	30.17	<1.05	41.0x	41.05	\$0.1>	20.15	\$0.12	<1.cs
1,3-DHB	\$96.05	SDE:07	₹6.39£	sbe o>	SIZ:07	८० उन्ड	20 XIS:	<0.2°15	40.245	S>C.0>	Z1-C-0)
an .	८० ज	12.0>	15.0	15.07	(c.2)	10.07	⟨c.21	12.02	16.07	12.03	1207
Tetryl	(3.5°	<3.5	5.5>	43.5	2.67	42.5	(2.S	5.62	50)	(2:5	7.52
2, 4, 6-THT	40.9C	9b.0>	9b: 3}	56.95	96.3>	4e.96	40.96	. 4c.96.	40.96	<0.96	2605
2,6-DNT	ot · Ø	०८ ७५	0c.3>	0c-5>	ac-3>	ar o>	0e-2>	00.0>	ac 3)	ac o	ac o
2,4-DNT	15.3>	16.35	16.02	16.37	(c.2)	K 07	10.07	10.07	10.07	16.02	<0.21
-04/00 DON	· Lefs	Le/3	Lel3	12/3	2/27	14/8	10/3	udis	10/3	15/3	15/13

DATA SUHHARY

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Note: Data is corrected for dilution, '

Comment: Tis Post test Sumples

MATEIX	R.	×	N	K.	3	3	3	3	
LAB ID	629-	-150 924	-}co	-}- 62%	639	626	7 6	- 600	
Sample Description	TAS SHRA Ry	TIS SHELL	TIN CP	TIS BIE	TIS SM TIS SIM	•	Tin Flesh	Tim Flesh The Flech	
Dilution			44	-	-	-	-		
Sample vol: /wt	308 m	300ml	ırpı	250.1		1	1	1	
	فتوان جزائله								
תווינכ	45[m]	12/64	13 Sm	ms m	total ap Lated my		मा ह्या के का दान	10th July 1	
ннх	<0.635	36.J.S.	(1.a7	<6.635	(12.7	412.7	(12.7	Leix	·
RDX	60.49	64.9X	\$6.0>	640>	49.8	49.8	2.67	. 8.8>	
1,3,5-TNB	<1.05	<1.05	\a.cq	<(I.c.s	630.9	4.062	4.06>	6-36>	
1,3-DNB	Sbc.0>	40 29S	(0.589	(6.295. KS.97	(S.87)	12:57	18:5>	58:33	
NB.	01£.6≯	46.310	₹€.4F	(6.210	Pi-2>	₹29.¢	<,50.0	<50 o	
Tetryl	3.8>	22.5	6.5.5	25.5	630,0	6350	0.037	78.0	
2,4,6-THT	3P.05	26.02	(1.92	46.96	1.3 51	1.25	1.93	5.0.j.	
2,6-DNT	¢0.30	<6.30	0h.0>	\$6.20	<4.0	2.77	44.0	9.57	
2,4-DNT	(e.2)	16.02	2h.0>	(O. 2)	1.7.7	. Ch.1	1.6 J	1.5.7	
CA (a.c. Dr. Vic.	2(31	دهای	Le)8	72/2	Lels	Lels	रम् अ	8(27	
							•,		



ROY F. WESTON, IMC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20 RFW : 8907L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager

Denville Analytical Laboratory

ated.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA CUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.

MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO* This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/20/90

	SATHAMA-HWAAP R: 2281-08-02-0000	WESTON	BATCH #:	CH #: 8908L462								
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTIN LIMIT							
-001	T14 SM W2 ETOH (POST	NITRATED ESTERS	5.0 u	UG	5.							
-002	T14 FC WALLS W2 ETOH	NITRATED ESTERS	20.3	UG	5. "							
-003	T14 POST WIPE BLANK	NITRATED ESTERS	5.0 u	UG	5. *							
-004	T15 PRE SM W2 ETOH	NITRATED ESTERS	6.6	UG	5.							
-005	TIS PRE WIPE BLANK	NITRATED ESTERS	5.0 u	UG	5.							

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	JSATHAMA-HWAAP ER: 2281-08-02-0000			WEST	WESTON BATCH #:				
SAMPLE	SITE ID	ANALYTE		RESULT		UNITS	REPORTING LIMIT		
BLANK10	89LNC012-MB1	NITRATED	ESTERS	2.5		MG/L	2.5		
BLANK20	89LNC012-MB2	NITRATED	ESTERS	2.5	u	MG/L	2.5		

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L46

SPIKE#1 SPIKE#2 %DIFF SITE ID ANALYTE SAMPLE SITE ID 95.2 97.6 2.5 BLANK20 89LNC012-MB2 NITRATED ESTERS

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L462

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
***		**********		*****		****
BLANK10	89LNC012-MB1	NITRATED ESTERS	10.1	2.5 u	10.0	101
BLANK20	89LNCQ12-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	48 8	2.5 11	50.0	97 6

ROY F. WESTON INC. INORGANICS DATA SUMMARY REPORT 02/21/90

CLIENT: USATHAMA-HWAAP

WESTON BATCH #: 8908L53

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	LIMIT
-001	T15SMW2 POST TEST	NITRATED ESTERS	5.0 u	UG	5
-002	T15SM FB POST TEST	NITRATED ESTERS	5.0 u	UG	5 •
-003	T15 FLSH CHMB WALLW2	NITRATED ESTERS	7.9	UG	5.>
-004	T15 FLSH CHMB WALLBL	NITRATED ESTERS	5.0 u	UG	5 .

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/21/90

		SAIHAMA-HWAAP R: 2281-08-02-0000			ME21	UN	BAICH #:	89081534
•	SAMPLE	SITE ID	ANALYTE	•	RESULT		ÚNITS	REPORTING LIMIT
	BLANK10	89LNC012-MB1	NITRATED	ESTERS	2.5		MG/L	2.5
•	BLANK20	89LNC012-MB2	NITRATED	ESTERS	2.5	u	MG/L	2.5

INORGANICS ACCURACY REPORT 02/21/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 WESTON BATCH #: 8908L53

SAMPLE	SITE 1D	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RE(
BLANK10 BLANK20	89LNC012-MB1 89LNC012-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	10.1 47.6 48.8	2.5 u 2.5 u 2.5 u	10:0 50.0 50.0	10; 9! 9;

INORGANICS DUPLICATE SPIKE REPORT 02/21/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L534

SAMPLE SITE ID ANALYTE SPIKE#1 SPIKE#2 %RECOV %RECOV %D) FF
BLANK20 89LNC012-MB2 NITRATED ESTERS 95.2 97.6 2.5

TEST RUN 16 600°F/6 HOURS

1311R2

1-02- ate Gue 02- 02- 02- 02-	liner folume				
1496 02- 10ue 150 N VDescription	olume o				Hab Only
1010 OZ- Johnson VDescription	/olume	100			Samples Were:
Fig. 10 So N. Nascription No. PRE N.	g			-	1 Shipped or Hand-
Johnson VDescription Ma					Delivered NOTES:
Client ID/Description	REQUESTED	Jan Jan			2 Ambient or Chilled NOTES:
TIB SSRIWI TOP PRE	Date Co' acted				3 Received Broken
	B/24/67	×			Leaking (Improperly Sealed)
TIP 558 1 W 2		×>			Y NOVES.
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	8/याद्य	X			NOTES:
7655R L		×			5 Received Within
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GOR TILSSAI WAS BODM PRE	•	×			NOTES:
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010 TIB SSR 2. WZ 1 1		×			e c
CII T16 55R 2. W.3		X			Package Y N
55RE		<u>ر</u>			Package Y N
					3 Present on Sample
Metris: W. Water DB. Drum Solids Special Instructions: S. Soli O. Oki E.L. Drum Liquids Special Instructions: SE. Sediment A. Air F. Fish SO. Solid X. Other	7-16 PRE TEST Gos 'F 1/2 he.	ETEST SAMPLES	1.65		
Item/Rowson Relinguished by Received by Date 1	Time Nem/Reason	ton Relinguished ty	Received by Date	te Time	COC Record Was:
					of Samples Y N
					Discrepandes Batwaen
					Sample Labels and COC
					•

RFW 21-21-001/A-5/88

Custody Transfer Record/Lab Work Request

TANGO WAY	WESTON Analytica	Samples Were:	Shipped or Hand-	NOTES:		2 Ambient or Chiled NOTES:	3 Received Broken/	Leaking (improperly Swaled)	Y N NOTES:	4 Property Preserved	Z -	NOTES:	x S Received Within	Holding Times	NOTES:	COC Tape Was:	rtet.	Package Y N	Package Y N	3 Present on Sample	ejde E		COC Record Was: 1. Present Upon Receipt of Samples: Y N	Ween	Sample Labels and COC	-	
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anh											+										SAMPLES			+	+		\dashv
cusiony Iransier necora/Lab work nequest																			,				Received by				
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ler ne		HOY JOH	Juine			100 A	cled	× 13/17/9	X 8811								·				1-16	600°F/64c.	Nem/Resson				
rans	Retrigerator#	#/Typo Conteiner	Containers/Yoluine	Preservative		ANALYSES REQUESTED			11.26 8/24/89		_												Time				
)ay	Rely	#/TY	Con	Pres	L	₹	Matrix	MIZ		•											tructions:		Daie				1
Cusic		11113110	2				escription	(स्ट्राइर)	BLANK TE												Special ins		Received by				
WESTON Analytics Use Only		Chiland Island	u 7		ong specific Date	RFW Contact No. 2044 204	Client ID/Description	The SH WI	FILSH WIP BLANK			٠									W.Water DS. Brum Solids O.Oli DL. Brum Liquida A. Ar F. Fish		Relinguished by				
WESTONA	بنيداري				Date Rec'd.	RFW Contact 12:25 Client Contact/Phone.	WA Use Only		619		v										Matrix: V B. 30# G. S. Willers	. 1	Nam/Reason				

7-115

1 Present Upon Receipt 4 Unbroken on Sample NOTES: Y Leaking (Improperty 3 Present on Sample Package Y 2 Unbroken on Outer 4 Properly Preserved 2 Antolent or Chilled NOTES: WESTON Analytics 3 Received Broken 1 Present on Outer 1 Shipped or Hand-Delivered z 5 Received Within Package Y COC Record Was: Holding Tines COC Tape Was: Samples Were: Sealed) NOTES: NOTES: Use Only NOTES: NOTES: Time Date **Custody Transfer Record/Lab Work Request** Heceived by SAMPLES Relinguished by が出 600 F/6 has PZG Hem/Resson S. S. X 8/4/89 8/24/6.7 ANALYSES PEQUESTED 6/14/8 841181 Containers/Volume 8/74/189 Collected 7-16 #/Type Container Refrigerators 200 Preservative Time. 43 A 42 Matrix AG 88 84 AD ิง 76 AB Special Instructions: Date TIL PE FIELD PLANK, PRETAT EST The CP FICE BLAKE PE TOT RST RE TST PRE FEST Date Recty.

BFW Contact MACE 124 , John 190 = Received by TRE PRE 恕 3 Pec H.C. 4.4F Client ID/Description DS - Drum Solids DL - Drum Liquids F - Flah X - Other Work Order 2281-08-02 R3 RY RX 82 Relinguished by TI6 QP 51 182 WESTON Analytics Use Only TILO 882 71 PBZ TIE PB 2 VKATHANIA, T16 PB1 B 14 PB Cilent Contact/Phone ... W - Waler O - Oil A - Ar

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Sample Labels and COC Record? Y N

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Sample Labels and COC Record? Y N NOTES: 4 Unbroken on Sample 1 Present Upon Receipt Discrepandes Between 3 Present on Sample Leaking (Improperty 2 Unibroken on Outer Puckage Y 4 Properly Preserved VXXXXXXXX 2 Antilent or Chilled NOTES: WESTON Analytics 3 Received Broken/ 1 Present on Outer 1 Shipped or Hand-Delivered 5 Received Within of Samples Y COC Record Was: Holding Times Package Y Samples Were: COC Tape Was: Sealed) NOTES: Use Only NOTES: NOTES: NOTES: NOTES: Time Date Custody Transfer Record/Lab Work Request Srike Afflicator Received by Relinguished by PRE TIG J. O. M. 649 Nem/Reason Rnee Matrix Date Collected A-Q B-125/89 AQ 8/25/8º Containers/Volume ANALYSES P 6/Type Container Refrigerators Preservative Ime Special Instructions: Dile The SOLKT APPLICATES RIASS Date Rec'd. N. Johnson, M. MAZILON The SAKE APPLIATE PINSE Received by C" at INDescription DS - Drum Solids DL - Drum Liquids F - Fish X - Other HINAAP Work Order 2281-08-02 3908 Hw. 028-Client Contect?!: one Relinguished by WESTON Analytics Use Only USATTANA . W - Water 0 - Oil A - Air RFW 21-21-001/A-5/88 tem/Reason E - Sediment WA Use Only 633 153 Cilent . 50 Solid 3

EXP = EXPLOSINES

WESTON ANALYTICS EXPLOSIVED

DATA BUHHARY

V8 25 89 Analytical Lct
Date Prepared
Date Analyzed 5/25/84 RFW Batch GAIGE STAFE
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Note: Data is corrected for dilution, '

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EHX	CO.635	605 6.55	419.7	137	(1.27	48.44		
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Tetryl	(3.5	22.3	450.0	76.38	0.57	7.71.3		1
2, 4, 6-THT	40.96	74.87.	419.2	15 81.47.	41.92	%.r.		1
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WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

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Analytical Lot	Date Prepared	Date Analyzed
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RFH B	Insta	Hatri

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-	8.15	3.74 ohc	8.5>		igial	8.67	3.25	\$ 4.5	64.07	\$4.0)	1
	6.1 7	17.63 K20.9	6:00)	6.96.5	1	433	6.2 J	630.9	(1:82	<1.05	
	KS.84	3.131	(5.89	68.57		\$4.57	4.63€	68.5>	, Sec.0)	(C. 29K-	
	61.47	19.4	₽.±>	#-9 F	1	ロナン	64.19	61.19	70.31c	40.210	
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WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

Analytical Lot Installation HAUTHCRNE
Hatrix: Ringell Usipe, Stil

83 35 8 18 SE S Date Prevared
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Note: Data is corrected for dilution,

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œ	ಶಿಕರ	7697	The SSR3	1866	30	120							5500			30%
ď	.350	.032	71c 55,22	(60	30	71 8	5.697	645	4105	\$.P6>	مالد	93c)	\	230 e	20.05	sels
ጽ	38	10	TIGESAL	0941	30	1mE 3m							1485 B			seja
Α,	300	631	T16 55121	190	90	W. SU	₹63.Σ	6417	₹10 Σ	(इस.इ.	८अ	952>		(30. c	15.51	Se)8
R	300	-030	Tie CP	_	250ml	15 m	(0.635	८५ ०७	50·1>	4c.295	५८.अ०	43.50	4e.96	40.30	الدبك	sels.
S	. BC3	P60-	15 do	10000	1 cpm	MS Sm	<12700	0086)	onbæ)	06857	44190	49200	000561	24000	(dact)	sc)
R	. 823	- C28	TIG 78	-	250 m	UKINA	(0.635	64.0>	20.17	.{o.πs	\$10.0X	(2.5	76.05	az 0 >	12.0>	scla
MATRIX	LAB ID		Sample Description field Bik (CP 5)	Dilution	Sample vel: / wt	Unite	них	RDX	1, 3, 5-THB	1,3-DNE	an .	Tetryl	2, 4, 6-THT	2,6-DNT	2, 4-DNT	offer son

Sample Lahels an. 1 COC Record? Y 1 Present Upon Flocelpt 4 Unbroker, on Semple NOTES: V Discrepandus Berween Leaking (Improperty Sealed) Package Y 2 Unbroken nn Cuter 3 Present on Semple 4 Properly Preserved 2 Amblent or Chillad NC/ES: Sanples Were: 1 Shipped or Hard: Dailvered 3 Received Brokers WESTON Analytics 1 Present on Out Z 5 Received Within of Sample, Y COU Record Was: Holding Times COC Tape Wes: Package NOTES: NOTES: Use Only NOTES: NOTES: NCTES: 1 5 ate 1 1fme CHKS, @ 600'F Received by Rell aulsined by itanumenson Post-Test 1 Containers Notura ANALYSES PEROUESTED Matrix Date Collected ACN ISISI 89 #/Type Container Refrigerators Preservative Im Support Rack TIG SSRIWI ROSH WIPE Special Instructions: Dete Post FieldBkmk Field Blank R3 E W5 Dele Recid. M. Johnson M. Marelon SHING RI S 3 エヌ 83 **R**1 Received by Pawder Box T16 PSI R1 Client Contact/Phone 215 - 430 - 3117 Client ID/Description D3 - Drum Solide DL - Orum Liquide F - Fish HWAAP Heated Riser Tile 2391- 64-02 Relinculated by 8908 HW 030 X · Other WESTON Analytics Use Only Client USATHAMA W-Waler O-Ou A-At-Work Order tem/Resson SE - Sediment SO - Solid WA Use Only 500 20 <u>ک</u> 90 5 400 410 900 <u>a</u> 210 200 609 490 500 0 100

Custody Transfer Record/Lab Work Request

Sample Labels and COC Record? Y N 1 Present Upon Receipt 4 Unbroken on Sample NOTES: Y Discrepandes Between Leaking (improperty 3 Present on Sample 2 Urbroken on Outer WARSINGE Properly Prese, ved 2 Ambiant or Cialed NOTES: 3 Received Broken/ 1 Shipped or Hand-Delivered NOTES: WESTON Analytics 1 Present on Outer 5 Recoived Within Package Y COC Record Was: of Samples Y Holding Times Package Y Samples Ware: COC Tape Was: Sealed) NOTES: NOTES: NOTES: Use Only P P Dete **Custody Transfer Record/Lab Work Request** 600°F Received by **®** Relinguished by GHRS. Hem/Reason 28 IC 8 Containers/Volume ANALYSES PER PEQUESTED Date Collected Post-Test #Type Container Proservative Ilme Mire Matrix ACE ACN Special Instructions: Date \$ Field Blank Rack TIE SSRIMG Post Field Blank **8** notage M. Mazelen Field Blank TIG AM WI Past Field Blank " " Field Blenk و | 3 3 R3 R Heated Valve Tib SHVI RI S Received by 3117 ラ Client iD Description WAAP DL - Drum Liquida F - Fish X - Other RFW Contact N. John Son M. Clent Contact Phone 215 - 430 -= Tay Pige Tis CP Work Order 22-81-68-02 DS - Drum Solids 89044W-036-Thamber Nalls Relinguished by WESTON Analydes Use Only Ship Mine Client USATHAMA Trepart Trepart 0.0 A.≿ Item/Reason Date Rec'tt. 800 VA Use Ordy 030 350 Cdo 823 027 920 केट 950 8 910 291 919 370 100 3 - S 0

RFW 21-21-001/A-5/88

WESTON ANALYTICS SIPLOSIVES

DATA GUHHARY

Units Kned went of the Ansily Shire Analyst -Ais Reviewed 68/12/8 Analytical Lot
Date Prepared
Date Analyzed HALSTHORNE 68/11/6 RFW Batch OA OC Installation Hatrix: ...

	Oc Samples?
	e shr
tion, f	6000 F
for dilu	ost Test
Note: Data is corrected for dilution,	Tig-Post Test Google @
Data is	•
Note: 1	Comment

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N) (195.				enales enales es enales enales en	PR C	13.2	18:47	49.77, 20.8	470% S:71	9.87	1/1×86	. 1,5th	1/9.6%	
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3	lex wipe		_		parago dell'app (sp	किला मह विश्वापक	132	भिष ः निष्	_ <u> </u>	7	44.20 HO.C	500	1.20G	17446	
121	Blank				win alto .	ion m	(12.7	8.63	420.9	45.90			6.9.3	(4·0	The second secon
Œ	2 heade	erindik dipad			و وزور وساد	Mem	G.55	1 161%	18:5 18:5	97.47% 2.89	45%	7.ta 20	16.3	75.69	
œ	Rinscoll. Blank	بينانه ونبرانو	1			रिया जिल	Sec. W	P4.0>	(1es	क्रव	(0.210 3.0)	<2.5	46.95	40.20	
MATRIX	IAB ID #		Dilution	r		Unite	жжн	RDX	1,3,5-TNB	1, 3-DNB	. NB	Tetryl	2, 4, 6-TNT	2,6-DNT	

WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed Blail81, 91189 Installation HAWTHURINE HALFIX: RINGLY, Wer, Seil

Units Ringar usminipe lotsur, roll ugly Analyst Anslyst

6 From . 6 600 m Note: Data is corrected for dilution, ' TIG- Pest Test

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64.0% P4.0> P4.0> P4.0>
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00:0> (c.0> ac.0> ac.0>
16.0) 16.0) 15.0) 15.0)
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(1989)

WESTON ANALYTICS EIPLOSIVES

DATA BUHHARY

RFW Batch 89054W-630 Installation-HAWTHICRNE. Natrix: Ringle, wipe, Soil

Analycical Lot
Date Prepared
Date Analyzed

Units Rinsoll usful, wipe total up, still usly

Reviewed

Note: Data is corrected for dilution, "

Gook & Ghours Sampler Connent: TIG- Gest Test

HARTRIX	P	3	3	3	3	3	3	23	S	ø	23	
LAB ID #	-020	636-	030-	-060	630		030 0(8)	-083 6(9	020	-083 JE0	, 050 022	
Samph Descripto	SK TIC SSRIND	SKTIC	38 T.K 5581	*RTIG SWRJ WS	SRTIG	SRTIE ESRI NJ	SRT (6	इस. १ १६ इड्डिस इ.स. १६	12.5 F.C.	दर्भ माद महासि हार	SH TIE	
Dilution	-		-	-	ند	-	-	/	-	_		
Sample vol: but			ı	-	١	(·	1	(19m	250	l	
Unite	Total ur	不多	Total uf	יום לבין	पटांची बक्	Jn [-19]	الديما ملا	Taked my	ঠান্ত্র	125 m	Tetal RE	
	(12.7	(1a.7	(1a.7	(12.7	(12.7.	(La.)	(12.7	(12.7	(i.21	SE9 0>	(10.7	_
RDX	8.9)	S-6>	\$'6'>	8.6>	4.6>	8.6>	<9.8'	49.8	86.98	€0.44g	8-67	
1,3,5-TNB	P. 645 >	P: 0¢\$	6:00)	P.06>	p.09)	b'oe>	p. 06>	(20.9	(क.६५	(1.05	p. est>	_
1,3-DNB	65.40	6.90 (s.90	05:5>	<5.90.	05.2>	৫৮:১১	ob:3>	06.5>	(0.59	Spt.05	650	_
	4.30	z.h>	z.4>	4.47	z.h>	z.4>	z.h>	<4.2 <4.2	⟨0.42	<0.210	44.2	_
Tetryl	0.02>	qs>	9.57	ሪኔን	৫১১	es>	OS)	6 ,	(S.0	32>	3	_
2, 4, 6-THT	8.73	10.37	8.633	873	13.25	10.35	10.2 3	12.357	41.92	\$6.9¢	7.6 3	
2,6-DHT	4H.0	o.h>	44.0	٥٠٢>	0. h>	o.4.5	0.4>	C4.0	он.0)	00.0>	0.P>	
2,4-DNT	44.2	2.H>	1.03	Z-h>	てか>	1.05	てかゝ	1.039	∠4.0)	40.21	2.35	
EX (Oc took	- 4(3)	16/3	16/8	16/8	16/8	16/8	ie a	16/3	16/8	16/8	15/8	
200			•									

(1989)

MESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

काहिर नाहर Analytical Lot
Date Prepared
Date Analyzed Installation HAWTHORNE Hatrix: Ringel, Wife, Soil Rin Batch 8968-4w-030

Units Kinsalt usper, who balabus, soil usp. Analyst
Reviewed

Note: Data is corrected for dilution, '

GEOFF G Laws The great Pest Samples Connent:

																•
3	- 0E0	CH TIC		<u></u>	 -Angres	(12.7	4.6	6.92>	65.90	4.30	<50.0	10.87.9	0.h>	1.03.1	(6)8	•
٥,	630,	717 WJ	_		किनि पर	(19.7	8.17	b-ae>	45.90	<4.20	6.62 50.03	11.8社	0·h>	2.335	16/8	
R	950 ·	14V TIE 54V BIK Field-BIK	-	350	18 mg	SE9.0>	60.49	<1.c5	St. 6)	0۱۲.0>	(2.50	\$6.9¢	40.20	(6.2)	16/8	
R	-069 -069	# TIE		000)	اساعة	JC9.0>	\$#.@>	50.1>	Sbæ ø>	40.210	43.50	40.96	⟨0.30	16.07	18/3	•
	43	AV TIE SAVI		0091	128 m	263.05	bh.07	50.17	sbe-o>	01c 0>	(2.58	40.96	€.05.05	40.21	16/8	
8	240	#V.F16 5.41V!	_	0001	E8[m]	269.0	40.49	59.1 >	20.09	40.210	43.50	40.96	40.20	16.0>	18/8	•
R	70E0	TIE 147.11C	1	0201	#8 m	\$€9.0>	64.49	\$0·1>	इक्ट ०>	01e.0>	(3.50	26.9¢	40.20	40.21	iels	•
3	630-	SM TE	_	1	Teadust	(to:7	8 .6>	430.9	06·5>	रंभव्य	3.85	36.05 KO.96	«·н>	1.271	· 16/8-	
MAGTRIX	LAB ID	Single Doscriphum stru ar	Dilution	Sample the just	Units	хні	RDX	1,3,5-TNB	. 1,3-Бив	. NB	Tetryl	2, 4, 6-THT	2,6-DNT	T.4-DNT	ONTO DOL	٠(العلام).
							•		•						•	. 3

ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMA - HWAAP

SAMPLES RECEIVED: 09-02-89

RFW #: 8909L597 - RINSATES

W.C. #: 2281-08-02

SIPLOSIVE MARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02 modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

Reagent blank analyzed to provide an indication BLX = of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

88 Designates sample spiked with target compound. Designates sample spiked with target compound SSD in duplicate.

D Indicates duplicate analysis of a sample.

BK Not spiked.

Diluted below calibration range. DL

G Indicates elevated detection limit due to sample interference.

NR Not reported.

NOTE: Spikes have been reported as result

recovery).

Data Onalifiers

< = Less Than > = Greater Than

Analysis Summary

Samples Collected: 08-31-89 Samples Prepared: 09-07-89 Samples Analyzed: 09-22-89

1. Thick HI

10-13-89 Date

Carter Nulton, Ph.D.

Vice President/Laboratory Manager Lichville Analytical Laboratory

WESTON ANALYTICS EXPLOSIVES IN RINSATE DATA SUFMARY

RFW Batch Number: 8909L597		CLIEW	r: USAT	CLIENT: USATHAMA HWAAP	AP						Paga: 1
		TIESHVI	HV1	TI6SHRI		T16PB1	i ! !			1	1 f 1 1 1
Sample Information	ID : RFW#:	R1 00	DUP 001	R1 DUP 002		R1 DUP 003		BLANK		2XSS	
	D.F.: Units:		l Total ug	1 Total ug		1 Total ug	f t	1 Total ug	6n	1 Total ug	
	3. 通信有污渍的通道通信的通信的通信的通信的通信的通信。 • • • • • • • • • • • • • • • • • • •			254	*	254	*	1.27		3.09(120%)	
RDX		> 196	9	196	٧	196	٧	0.98		2.22(112%)	
1,3,5-TNB	• • • • • • • • • • • • • • • • • • • •	*	8 1	418	٧	418	٧	7.09		4.45(1054)	
1,3-DNB		::	8 1	118	٧	118	٧	0.59		1.25(1054)	
NITROBENZENE	•	~	×	. 84	٧	8	v	0.42		0.84 (99.2%)	
TETRYL	• • • • • • • • • • • • • • • • • • • •	> 100	× 00	1000	٧	1000	v	5.00		7.18(71.18)	
2, 4, 6-TNT	• • • • • • • • • • • • • • • • • • • •	36 >	*	384	٧	384	v	1.92		2.95(75.8%)	
2,6-DNT	• • • • • • • • • • • • • • • • • • • •	.	01	80	v	80	٧	0.40		0.88(1084)	
2,4-DHT	• • • • • • • • • • • • • • • • • • • •	~	*	84	٧	7	v	0.45		0.87(103%)	

Information RFW#: D.F.: Units:	RFW#: D.F.:			
United the second secon	D.F.:	10XSS	10XSSD	
HMX	Unite:	Total ug	1 Total ug	
RDX		15.2(118%)	15.0(117%)	7
	• • • • • • • • • • • • • • • • • • • •	10.9(1111)	10.7(1094)	
1, 3, 5-TMB	•	22.2(105%)	22.1(105%)	
1,3-DNB	•	6.20(105%)	6.22(105%)	
NITROBENZENE	• • • • • • • • • • • • • • • • • • • •	4.17(98.98)	4.22(100\$)	
TETRYL	• • • • • • • • • • • • • • • • • • • •	49.3(97.7%)	47.7 (94.48)	
2,4,6-TNT	•	17.9(92.78)	17.1(88.4%)	
2,6-DNT	• • • • • • • • • • • • • • • • • • • •	4.28(106%)	4.41(1094)	
2,4-DNT	• • • • • • • • • • • • • • • • • • • •	4.16(98.38)	4.31(1028)	



ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,16,20,22,29, 9-2,11,20 RFW #: 8907L058,059,154 8908L203,258,315,398,462,524,534,595

8909L595,679,804

W.O. #: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager Chohville Analytical Laboratory

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA OUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- * Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicate.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.

MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eq. MAGSO indicates an analysis for soluble milver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC. INORGANICS DATA SUMMARY REPORT 02/20/90

	JSATHAMA-HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8908L524
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REFORTING .
-001	T16SMW2 PRE TEST	NITRATED ESTERS	5.0 u	UG	5.0
-002	116SM WIPE BL PRIEST	NITRATED ESTERS	5.0 u	ug	5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L52

SAMPLE	SITE ID	ANALYTE	RESULT	STINU	REPORTI LIMIT
BLANK10	89LNC012-MB1	NITRATED ESTERS	2.5 u	MG/L	2
BLANK20	89LNC012-HB2	NITRATED ESTERS	2.5 u	MG/I	2 .

•

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000 WESTON BATCH #: 8908L524

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10 BLANK20	89LNC012-MB1 89LNC012-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	10.1 47.6 48.8	2.5 u 2.5 u 2.5 u	50.0	101 95.2 97.6

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-: WAA? WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8908L5

SPIKE#1 SPIKE#2
%RECOV %RECOV %DIFF SAMPLE SITE ID ANALYTE 95.2 97.6 2.5 NITRATED ESTERS BLANK20 89LNC012-M32

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

	ER: 2281-08-02-0000	•	MESTON DA	(1Ch #. 0303E333
SAMPLE	SITE ID	ANALYTE		REPORTING INITS LIMIT
-019	T16SMW1POST	NITRATED ESTERS		G 5.0
-020	TIGSM FIELD BLANK	NITRATED ESTERS	5.0 u U	G 5.0
-021	T16 CHAMBER WELL W1	NITRATED ESTERS	5.0 u U	G 5.0
-022	T16 CHAMBER WELL BLA	NITRATED ESTERS	5.0 u U	G 5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	ORDER: 2281-08-02-0000		MESTON	DAILH #:	9303133
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTI LIMIT
BLANK		NITRATED ESTERS	2.5 u	MG/L	2
BLANK2	20 89LNCD12-MB2	NITRATED ESTERS	2.5 u	MG/L	2 🍁

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L595

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
*****		*****************	*****			*****
BLANK10	89LNC012-MB1	NITRATED ESTERS	- 10.1	2.5 u	10.0	101
BLANK20	89LNC012-MB2	NITRATED ESTERS	47.6	2.5 u	50.0	95.2
		NITRATED ESTERS	18.8	2.5 u	50.0	97.6

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 8909L59

SAMPLE	SITE IN	ANALYTE		1 SPIKE#	_
*****	*************************************				*****
BLANK20	89LNC012-MB2	NITRATED ESTERS	95.2	27.6	2.5

TEST RUN 17 600°F/48 HOURS

7-115

PFW 21-21-001/A-5/88

Sample Labels and COC Record? Y N 1 Present Upon Receipt 4 Unbroken on Sarriple NOTES: Y Leaking (irreroperty Sealed) Discrepandes Between WAS DAILY 3 Present on Sample 4 Properly Preserved 2 Unbroken on Outer 2 Amblant or Chiliad NOTES: WESTON Analytics Received Brokery COC Tape Was: 1 Present on Outer 1 Shipped or Hend Delivered 5 Received Within Package Y Holding Times COC Record Was: of Samples Y Package Y Samples Ware: NOTES: Use Only NOTES: NOTES: NOTES: Time **Custody Transfer Record/Lab Work Request** Date Pre Test GOOF @ 48 bours Received by Relinguished by llen/Resson Collected & 35 Containers/Yolume ANALYSES THE REQUESTED TO #/Type Container Refrigerators 5 Prescryalive Ilme 71 Matrix Yer V Special Instructions: Dete RFW Contact N. Jest N. 5041 M. W. AZELDN. Clent Contact Phone (215) 4-30 3117 SP Field Blank य हु के Feceived by 3 Client US & THAMA / HUJASP Client ID/Description Work Order 2231-08-02 प्रक्रम Dt. - Drum Siquids CS - Drum Solids इनेस्टा कोक्टाय Relinguished by WESTON Analytics Use Only F.Fish M-Cibe 8008 Hen-03 श्रम् AFW 21-21-001/A-5/86 0.0 A.Ar Item/Resson WA Use Cidy E - Sediment 726 Ba 031 No. Solid 3: वै 8

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Sample Labels and COC Record: Y N 1 Present Upon Receipt 4 Unbroken on Sample NOTES: Y Discrept.:des Between Leahing (Improperly 3 Present on Sample 2 Unbroken on Older 4 Property Preserved
Y 2 Antilant or Chillad NOTES: 1 Shipped or Hand-Dulivered NOTES: 3 Received Broken WESTON Analytics 1 Present on Outar z 5 Received Within Package Y COC Record Was: of Samples Y Package Y Hading Times Use Only Samples Were: COC Tupe Was: Sealed NOTES: NOTES: NOTES: NOTES: NOTES: Tim. Dule Custody Transfer Record/Lab Work Request TIT Pre Test GOOF @ 48 hours Received L. Relinguished by New Reason Containers/Volume ANALYSES PEQUESTED प्रिटित Collected #/Type Container Refrigerators Date Preservative Time Matrix Len Special Instructions: 200 R3 R4 TIZSHR FIELD BLUX TIT SHY Fleid Dlan steam heated value Tizshin BFW Contact N. JOHNSON / M. MAZELON 12% K Ş 접조 R3 TIT SHRI RI Received by steam Heapen Risers Client Contact/Phone (219) 430 311 Client iD/Description T1754172 DL - urum Liquida F - Fish X - Uther Client LSATHAMA / HWIAAP Work Order 3281-08-02 DS - Drum Solids Pallinguished by WESTON Analytics Use Only 8902 Hen-031 M - Waler 9. ₹ ••• Herri Reason 350 E - Sedensin 240 643 WA Use Only 350 **अस्** 035 037 633 07.5 750 C tel 038 730 037 3

7-115

1 3 Received Brokent Leaking (improperty Sealed) Y 4 Unbroken on Sample NOTES: Y N Sample Labels and COC Record? Y N NOTES: 1 Present Upon Hecelpt Discrepandes Between 3 Present on Sample 2 Unbroken on Outer 4 Properly Freserved
Y W. Comer Samples Were:
1 Shipped or HandDuivered
NOTES: 2 Amblent or Chilled NOTES: **WESTON Analytics** COC Tape Was: 1 Present on Outar 5 Received Within Package Y COC Record Was: of Sa aples Y Package Y Holding Times NOTES: NOTES: NOTES: Use Only Tinie Date **Custody Transfer Record/Lab Work Request** Received by PRETESS Hem/Reason | Relinguished by SAMPLES 8 Containers/Volume 18/01/8 Date Collected ANALYSES PED REQUESTED #/Type Container Rafilgerators Preservative Ime Matrix 40 Special Instructions: Dek 72.B.T Bele Rec's. W. Johnson, M. MAZELON Peceived by Cilont ID/Description HALLAPP 222 181 49 DS - Druin Soilds DL - Drum Liquids Work Order 2281-08-02 SHV2 Relinoulshed by F-Fish X-Cthat WESTON Analytics Use Only 8908-460-03 Calent Lynnighto Client Contact/Phone__ W - Waler O - Oil A - Alr RFW 21-21-001/A-5/86 **Nam/Recson** Dete Rec'a. 3E - Sediment MA Use Only 370 949 Cata 10 047 940 10 - Sell3

]

WESTON ANALYTICS EXPLOSIVES

DATA BUIHARY

Units Rinsolf Mc mJ Analyst Reviewed																		
Analytical Lot Date Prepared Date Analyzed	Data is corrected for dilution,	Fre Test Sumple (BC @ 600 F 44 48 br.																
8.6 ENSE	ted for	1	R	10x Rinsolt		_			m 371	16.55	- H	16 F	1361	12.15	1067.	_	12.0y	
ch CMGe 9/1/89 ation HALVITHERNE	COLFEC	717	R	Block	Ringel				Jun 378	(0.635	bh ·0>	50.15	sec:0)	(0.210	s.c)	76.95	oc 0)	(0.21
RFW Batch Or Installation Matrix: Rin	Notes Data is	Comment:	MATRIX	LAB ID #		Dilution	•	•	knils	них	RDX	1,3,5-TNB	1,3-DNB	9 N	Tetryl	2,4,6-THT	2,6-DNT	2,4-DNT

WEBTUN ANALYTICS EXPLOSIVES

DATA BUICKARY

NFW Batch 8908 4441-631 Analy Installation HAWFIERNE Date Hatrix: Alnsolt bate

Analytical Lot
Date Prepared
Care Analyzed

Units Rived us my Analyst __Aic Rovieved

Note: Data is corrected for dilution, "

Comment:

TIT Pre Test Samples 600% @ 48 hours.

r				l 1	 		I	i	l	!	l				1
8	-169 -031	SpTinsp Field Bik		232	US In	<0.635	6h.0>	41.05	20:295	اتــ٥>	2.5	\$6.9¢	<0.2.0 \	16.0>	5
Ø	150 (Sec. 030)	SPTITSP CEPTITSP RI-ARY Field Bik		21 25. 22 25. 25 25. 25 25. 25 25.	J55 m	SE9.0>	40.49	\$0.1.5	SbE:0>	(0.21	3.c>	40.96	<6.30	\c.a\	16
α	C33 30X	Sp Fitspi Ris Rd	-	0.72	MS m	(0.63C	bh.o>	41.65	Special S	(c.0)	ζa.5	26.95	\c.30	(0.21	=
ĸ	150	APTITAP Field BIK	_	280	m 3.24	269.63	(G.41)	.xo-1>	5 bc. 0>	1€.0>	5.E>	40.96	<0.30	16.0>	
α	150 618-7031	APTITAPSIAPTITAP		24.54 24.54 24.54	116 m	6.75	17.3	50·1>	<0.29S	16.0>	34>	0.545J	<0.30	(6.9)	#16 .
Œ	C106-410	1	0)	18. 350 18. 350 18. 250	 112 21		36.3								116
צו	Lio tho	Patites Patites Patites Motions; Motiona, Risary Risary Risary Risary Risary	_	25 - 25 25 25 - 25 25 25 25 25 25 25 25 25 25 25 25 25 2	MS m	5.4A		.30.1>	26.29S	(6.21	(a.s	7.2	o∈ o>	100>	116
ĸ	-619-	PBT11PB Tidd BIK	_	250.11	A45 mJ	369.0>	6.49	41.05	<0.295	<0.21	5·E>	७ ४७%	0€.0>	16.0>	116
œ	Liot-100	PATIT PAS		A-250	14)3m	\$69.0>	0.117	30.15	ste o>	15.0>	5.6>	€.9¢	oc.o>	16.0>	1)6
Q	8004-5W	PBTTFB1			 1.05 m	SE9.0>	0.10 7	\$0.	Sb2.0>	16 0>	(a.3	20.9¢	₹0.0}	₹.0>	16
X	1001-1001	PET 17	-	41.350 41.350 41.350	 UE my	\$E9.0>	64.0>	50.5	(o.295	16.0>	5.6>	0.11 7	(0.20	10 X	116-
MATRIX	FAB ID 4	Sample Description Par - RAR RI- RR	Dilution	Sundle Yoli	UniB	них	RDX	1, 3, 5-TNB	1, 3-DNB	ar .	Tetryl	2, 4, 6-THT	2,6-DNT	2,4-DHT	-CH(ac Date)

WESTON ANALYTICS EXPLOSIVES

DATA BURHARY

Ringall 115 mil Units Analyst Reviewed 11/8 Analytical Lot Date Prepared Date Analyzed RFH Batch 8908 440 631 Installation Attended Hatrix: Rinsol

Note: Data is corrected for dilution, "

@ 48 hours

600°F

Pre Test Sumple

414

Comment:

ż	Pior sho	117 54UP		25. 25. 8	 Jul 84	\$69.0}	64.0>	<1.05 ·	<0.295	15.0>	2.5>	76.07	<0.20	1.77	
R	-163	544 GIK		25.6	P45[m	SE9.0>	P4.0>	<1.05	\$15.05	16.03	5.e>	40.9C	& . S	⟨€.21	6
. &	-1E0	7	-	2 13. 2 13.	#4 w.	0.10 J	60. 49	<0.1>	\$ 6.2€\$	1C.6>	5.6>	36.0>	(O)	2.64	4
X	-160	RITHER SHATITSME SHIV TO	_	ase	4.84	3690>	6h.0>	<1.05	Sbc.6>	त.0>	(a.5	76.05	&c .0>	16.02	76
8	03 40%	SIN RI		3000	lus su	10e.0	17.5	50·1>	५०.०५	16.07	S-E>	C51:0	oc. 0⟩	16.0>	76
ζĭ	150-150	Significal Rinks		- 166 - 166	6.4 80	अट े ७	०।भव	501>	\$ 34.8	16.0>	s:e>	96.9>	8.00	1c.0>	1/16-
N. LAST RELY	LAB ID	Sample Decembrion	Dilution	Sample vol. (nds)	Unik	ннх	ROX	1,3,5-TNB	1,3-DNB	en .	Tetryl	2,4,6-THT	2,6-DNT	2,4-DHT	-CHOC SOFT

(1484)

ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMA - HWAAP 277 #: 8909L679 - WIPES SAMPLES RECEIVED: 09-11-89

W.O. #: 2281-08-02

EXPLOSIVE WARRATIVE

Samples have been prepared and analyzed according to U.S.G.S. methodology for picric acid.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

D

Description

Reagent blank analyzed to provide an indication BLK = of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

Designates sample spiked with target compounds BE

at 10x detection limit.

Designates sample spiked with target compound BSD =

in duplicate. Indicates duplicate analysis of a sample.

NB Not spiked.

Diluted below calibration range. DL

= Indicates elevated detection limit due to

sample interference.

MR Not reported.

Spikes have been reported as result NOTE:

recovery).

Samples have been analyzed for picric acid and NOTE:

results converted mathematically to ammonium

picrate.

Spike recoveries for these analysis ranged from NOTE:

Reported detection limits take 18% to 38%.

these low recoveries into account.

Data Oualifiers

< = Less Than and > = Greater Than

Analysis Swigary

Samples Collected: 09-08-89 09-13-89 Samples Prepared: Samples Analyzed: 09-29-89

Carter Nulton, Ph.D.

10-11-80

Vice President/Laboratory Manager Lionville Analytical Laboratory

WESTON ANALYTICS EXPLOSIVES IN WIPE SAMPLES

RFW Batch Number: 8909L679		CLIENT: 1	JSATH	CLIENT: USATHAMA-HWARP	ENGLALLERSHERERERERERERERERERERERERERERERERERER			Page 1
Sample	Client ID :	T17FC	-	T17FC	TIPE TIPE		***	
Information	REW#:	026		627	BLANK	BS 1	BS 2	bs 3
Units:	Units:	Total ug	19	Total ug	Total ug Total ug Total ug Total ug Total ug Total ug	Total ug	1 Total ug	1 Total ug
Ammonium Picrate		< 10	v	10	9.3(113%)	45(110\$) 41(95£)	41(951)	

ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMA - HWAAP

SAMPLES RECEIVED: 09-11-89

2FW 4: 8909L679 - WIPES

₩.O. #: 2281-08-02

EXPLOSIVE MARRATIVE

Samples have been prepared and analyzed according to U.S.G.S. methodology for picric acid.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

18 Designates sample spiked with target compounds at 10x detection limit.

BED Designates sample spiked with target compound in duplicate.

D Indicates duplicate analysis of a sample.

MB Not spiked.

DL Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

Not reported. MR

NOTE: Spikes have been reported as result

racovery).

NOTE: Samples have been analyzed for picric acid and

results converted mathematically to ammonium

picrate.

NOTE: Spike recoveries for these analysis ranged from

Reported detection limits take 18% to 38%.

these low receveries into account.

Data Ovalifiers

< = Less Than and > = Greater Than

Analysis Summary

09-08-89 Samples Collected: Samples Prepared: 09-13-89 Samples Analyzed: 09-29-89

Thruh

10-13-60

Carter Nulton, Ph.D. Vice President/Laboratory Manager

Lionville Analytical Laboratory

WESTON ANALYTICS EXPLOSIVES IN RINSATES DATA SUHMARY

RFW Batch Number: 8909L679		LIENT:	USATHAMA-HWAAP	刘州对刘州州和 刘州和刘州和		***************************************		Page: 1
Sample Information	Client ID : RFW#: D.F.: Units:	T17PB1R1 POST TEST 001 1 Total ug	T17PB1R2 POST TEST 002 1 Total ug	T17PB1R3 POST TEST 003 1 Total ug	TI7PBIR4 POST TEST 004 1 Total ug	H	T17FB FIELD BL 005 1	T178HV1R 1PSTTEST 006 1 Total uq
Ammonium Picrate			. 10	10	10	~	10	× 10
Sample Information	Client ID : RFW#: D.F.: Units:	T17SHV1R2 POST TEST 007 1 Total ug	T17SHV1R3 POST TEST 008 1 Total ug	T17SHV1R4 POST TEST 009 1 Total ug	T17SHV FIELD BLK 010 1 Total ug		T175HRIR1 POST TEST 011 Total ug	T17SHRIR 2FSTTEST 012 1 Total ug
Ammonium Picrate	•	10 <	10 <	10 <	10	v	10	< 10
Sample Information	Client ID : RFW#: D.F.: Units:	T17SHR1R3 POST TEST 013 1 Total ug	T17SHR1R4 POST TEST 014 1 Total ug	T17SHR FIELD BLK 015 1 Total ug	T17AP1 R1 016 1 Total ug		T17AP1 R2 017 Total ud	T17AF1 R3 018
Ammonium Picrate	٧	10 <	10 <	10 <	10		ij	•

WESTON ANALYTICS EXPLOSIVES IN RINSATES DATA SUMMARY

RFW Batch Number: 8909L679 CLIENT: USATHAMA-HWAAP		CLIENT:	USAT	USATHAMA-HWAAP	WAAP	新新期的政治科学			建加热机械加热性用加热机	Page: 2
Sumple Information	Client ID : RFW#: D.F.: Units:	T17AP1 R4 019 1	5n	T17AP FIELD BLK 020 1 Total ug	BI.K	T17AP 'f17SP1R1 FIELD BLK POST TEST 020 021 1 1		T17SP1R2 POST TEST 022 1 Total ug	T17SP1R3 POST TEST 023 1 Total ug	T178PIR4 POSTTEST 024 1 Total ug
Ammonium Picrate	•		V		٧	10	v	10	> 10 <	16
Sample	Client ID : RFW#: D.F.: Units:	T17SP FIELD 025 Total	BLK ug	858 BLANK Total	6 n	358 358 BS1 1 Total ug	858 BS2 Total	858 852 1 tal ug	858 BS3 1 Total ug	857 BLANK 1 Total ug
Ammonium Picrate	•	× 10	v	10		2.4(30%)	7.3	7.3(18%)	10.4(25%)	< 10
Sakple Information	Client ID : RFW#: D.F.:	857 851 Total	6n	857 852 852 Total	6n	857 BS3 Total ug	8 8 9			
Assonius Picrate	•	3.1(38%)	£	12.6(31%)	116)	13.1(328)				

WESTEN.

ROY F. SESTON, INC. Lionville Laboratory

CLIENT: USATHAMA - HWAAP

SAMPLES RECEIVED: 09-02-99

RIW #: 8909L595 - RINSATES

₩.O. #: 2281-98-02

BIPLOSIVE WARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02 modified for the analysis of rinsates.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

BS = Designates sample spiked with target compound.

BBD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample

interference.

MR - Not reported.

NCTE: Spikes have been reported as result (\$

recovery).

NOTE: Samples have been analyzed for picric acid and

results converted mathematically to ammonium

pictate.

NOTE: Spike recoveries for these analysis ranged from

18% to 29%. Reported detection limits take

these low recoveries into account.

Data Qualifiers

< = Less Than and > = Greater Than

Analysis Surmary

Samples Collected: 08-30-89 Samples Prepared: 09-06-89 Samples Analyzed: 09-29-89

Zohrich Hand

10-13-8

Carter Nulton, Ph.D.

Vice President/Laboratory Manager Lionville Analytical Laboratory

WESTON ANALYTICS EXPLOSIVES IN RINSATES DATA SUMMARY

RPW Batch Number: 8909L595		CLIEKT: USATHAHA-HWAAP	Traha-hwaap				Paja: 1
citent		T17SHR1	TITSHVI		8	1	
sample Information	RPW#:	00 X	010 010	BLANK	B3 1	88 2	BG 3
D.F.: Unit s :	D.F.: Units:	1 Total ug	100 Total ug		1 Total ug Total ug Total ug	Total ug	rotal ug
Ammonium Picrtte	•	< 10	25.1	< 10.0	1.5(18%)	12.1(29%) 12.0(29%)	12.0(294)

TEST RUN 18 500°Y/6 HOURS

1311R2

Custody Transfer Record/Lab Work Request Haliparaiora Woluna Presentitive Present Request Woluna Present	3.5 4.		NOTES:	Labels and CO	Discrepancies Between	of Samples Y N	COC Record Was:		4 Unbroken on Semple NCTES: Y N	3 Present on Sample		Package Y N	1 Present on Outer		NO.ES.	× × ×	Hokding Times	A Decolved Willsin	ÆS:	4 Properly Preserved		ES:	Seried)	Leaking (improperty	3 Received Broken	2 Ambient or Chilled NOTES:	NOTES:	1 Shipped or Hand-	Samoles Wiere:	WESTON Analytica	MASSACE A
Hetrigerators Individual State of the State of the Presservative Presservative ANALYSES ANAL		\downarrow	_	<u> </u>	-	1	-		ZES							_															ب.
Hetrigerators Individual State of the State of the Presservative Presservative ANALYSES ANAL		Ļ	 	\downarrow	-	4	Par		4116						<u> </u>					_				\vdash			\dashv				nes
Custody Transfer Record/Lab W Hetiggralors Freshware Volume Preservative Freshware AMALYSES AMALYSE							Roceived by	×	1																						Vork Req
Custody Transfer Recuestry Special instructions: Hetriggrapor Special instructions: Hetriggrapor Special instructions: Hetriggrapor Special instructions: Hetriggrapor Special instructions: Hetriggrapor Special instructions: The Date Time Hemiscoon	(Relingulahed by	30°F/61	18 PRE																						ord/Lab W
Custody Trans Hatrigarators ANALYSES RECOLUMN RECOLU							Item/Aceson	52								7 60/	×	X.	×	×	×	×	X	189 X	cled	ig.			•		fer Rec
Custody T Pression Volume Nation Volume RECURS RECU		†		T					al instruc				<i>716</i> (5	18/6	T		>			F				1		LYSES	rvative	ine	or Conta	gerators	rans
Custo		T		1	T	†	-		Speci		•		N.	2	-	7	1			t			-	AC	Ties.	11		No.	Y L	Heir	dy T
Sold Marked Mark							Ruceived by	Leachate	olida X - Other Iquida				1	L PRETET				Ì	1 325 735	Bhal Ver	>			PR= FRT)escription	uke Mittelin	430	7:30	9 6 4 4		Custo
							Relinguished by	2	3	الداء			CP 46	CP		7 64	1 A 3	-	3 PB 2	23	•		- R	PRI		N.JChase J/A	elen			40 0 37	nalytics Use Only
Weston Analysica Segrature Work Order 228 Work Orde							Nem/Russon		_		A-CX	*	C1/8	-20	S S	600	\$ 00	1.00	585	200	7100	690	2.00	53	WA Use Only	RFW Contact	Work Order	3		8909	WESTONA

EX9 = EXPROSINES

RFW 21-21-001/A-12/88

MESSICAL	WESTON Analytics	Saturdos Were:	Duli or d	2 An Nent or Chilled	MOIES:	Time of the state	N (frequet)	NOTES:	4 Properly Presurved	NOTES:		Holing Times	Y Y		COC Table Was:	ole C	2 Unicohen on Outer	Parkeye Y M	3 Proteint on Sangala	A Unkroken on Servite NOTES: Y	Time	_	Discrepancies Beinesil	Becord?	7.115
dy Transfer Record/Lab Work Request																				16 50 TEST SAWA	Riceived by Dute				
Record/Lab ն	79			\$\$				×l×		×	×	X								7-18 PA	son Relinguished by				5 4115 31110
y Transfer R		Votume	Preservative	ANALYSES FEAUESTED	Matrix Date	12. 8 9 W. F.							. }	11.18 9/4/39						Special instructions:	le Trans Herr/Reason				0/0
Custod		WANT	-70-	1. 1892 Elm	escription	Pat Kar	+ 2.		11 S 201620		17 (ሉ ጎ gr		d Blank				•		ilis K. Ouhar julis Leochate	Received by Dela				
WESTCH Analytics Use Only	4	7	=qv=1q77	FFW CONTACT OF 1504 1 11. 11. 22	Cilent IO/Description	1185521	7		(IS)		M	ካ ች ች		T18552 F126	-					W. Waint DS. Drun Sullús O. Oil BL. Drun Liquids A. Air F. Fish Wi. Wipe L. EPITCLP Leochate	follosulahad by				/A-12/88
WESTCHA	+ 6065	Cilent (15	Work Order	FFW Contacts	WAU-Ouly	हां हां	-	1000	6179	රු ම	ઈ	वर्व ८१०		ारक वट्ट						SE-SUB SE-SUBment / SO-Sulla	Item/Reason				RFW 21-21-301/A-12/88

WESTOR ATALYTICS EXPLOSIVES

DATA BUHHLRY

NFH Batch SACQ HU3-032 Installation AACJTHCKNG Hatrix: Rinsact

96 89 Analytical Lot Date Prepared Date Analyzed

Units Ring & Rem wife dead us, seil add.

Note: Data is corrected for dilution, ?

6 Frunt @ +30S Pre Test Samples るド Comment:

3	634	いいかいか	アンス・シ	-			1.4642	(12.7	3.53	5.83	34.55	D1:33	(30.0	1.5 J	44.9	(4.20 F	916
3	633	043	TIPESK TITESKE				A= (171 -8= 610)	C13.7	2.0 3	130A	45.Ac	5 H 2	4500	49.2	0.77	44.20	9 6
3	652	CIC +019	718350	0			1216 118		1.0841								9/6
Î	. ega	اداد سعدام اداد مداط	FLATBIR LOIS WHY LOS SOUL TIESSEN	-	1		Teld 04	7 1811		6369	ob:5)	187	450.0	216	64.0	44.20	96
3	}	5134-00	するから	-	1		मिया स	2.1 प्री प्रश	14.7 B	P.50.7	4.5)	9.79	o es>	(19.2.	4.c	4.20	2/6
ہے	560	= 0 -	The CP Fillink	_	85		E11) 5cr	\$650>	\$h.0>	<1.05.	\$K.03	60.20	43.65	76.07	o€:0}	16.03	c16
S	680	010	Seil	20	-125		\$ 9m	(1370	0.96)	०५७८)	01.5)	07.h>	(5100)	्रीट्याट्य <u>ो</u>	ooh>	०६५)	9 6
Vi	_	_	118 CP	စဘက်)	1 cm		क्री श्रेत				<u>`</u>						96
વ્ય	C22	CC6-3-69	R J.R.	-	2000 2000 2000 2000 2000	، جنين خاصه	L. 184.	40.CSE	40.44	<1.05	SK-07	40.21C	\$ 50	५० ५०	40.30	(o.a)	96
œ	033	500	T18 P.	-	350		1,434	363.05	84.03	₹0.03	\$9.24\$	(0.21C	(2.50	40.92	(0.30	K.0>	3 6
ď	1032	1304-103	115 mil	-	100 - 250 m		(m, k#	\$60.0}	15 21.0	(105	8 E.O	<0.210	٥5 د>	₹¢.96	(0.20	₹ 6.9 1	-46.
MARRIX	LAB ID I		Sumple Essentation Re- Re	Dilution	Souph Hir/Lit		Holi E	IUX	RDX	1,3,5-THB	1,3-DNB	. нв	Tetryl	2,4,6-THT	2, 6-DilT	2,4-DHT	Oxilae pak

WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

Analytical Lot
Date Prepared
Date Analyzed RFW Batch Edog 440 532 Installation Auchterics Natrix: Real 1490, Seil

Units Rinsolt usm, wipe totals, seil usly.
Analyst -Als.
Reviewed

Note: Data is corrected for dilution, '

T-14 Pre Test Surples 500°F @ 6 hours Comment:

MATRIX	3	
LAB ID 4	-693-	
the state of the state of	TESSHE	
שמעלי אמיניולייניי	WS-NE	
Dilution	-	
Sample 141/14	1	
Unis	Tetal uf.	
них	7:c1>	
RDX	\$·6>	
1,3,5-TNB	420.9	
1,3-CNB	ob:5>	
gn .	39.56	
Tetryl	6.067	
2, 4, 6-TNT	6.91	
2,6-DNT	64.0	
2,4-DNT	64.20	
Coylor Date	-916.	

WESTON ANALYTICS EXPLOSIVES

DATA BUHHARY

IFIE Batch (ALVOC 9 6 89 Analytical Lot naits Recall 41, we to the stallation hatcher to bate Prepared 16 89 Analyst Analyst Date Analyzed 9 6 89 Reviewed
--

comment: "T-18 Pre Test Sungles 500 t @ 6 hours/ Ox/Oc 524.

	-							·							
8) 195.					12 N	. X 62V [1.0]	94% 92)	. 121.1	9617	3.70	18 27.	1.8.1	125.57 3.42	3.cc
и	HENK !					A ST	(1.27)	\$ 8.0>	(2.09)	\$6.03	47 (a)	(S.o.	4.92	(0.4to	₹ z † . 0 >
3	wipe wipe		-			16 1. A. L. J. 15 1 15 1 15 10	1.7 his 5 hil	7.611	1,2 SII 24C	112% 1658 ·	42.9	112.7. Sea	111 Y	1.5h	47.1
3	Election of the		-			בות מצי	4.67 (13.7	8.65	6:0C)	085>	oz.#>	(50.0 562		ارد. درد.ه	1.74 as by
X	10x Rizste		1		·	15 .A.	kc 7.	15.1	N.0	. 103%. 3.c4	. 102% 2.13	1637. 135.7	7.501 17.5	7.501	12.19 12.19
X	Blank Pirant	النابه فالأناء	-			KS tol	40.63 5	P4:35	501)	40.295	(0.210	5.6)	26.0>	(o.2c	(o.21
MARRIX	IAB ID (·	Diintion	•	•	Unils	Xiai	RDX	1,3,5-THB	1,3-DNB	en .	Tetryl	2, 4, 6-THT	2,6-DilT	2,4-DNT

z Sample Labels and COC Record? Y N 1 Present Upon Receipt 4 Unbroken on Sample NOTES: Y Discrepandes Between Leaking (Improperty Sealed) No. 4 Properly Preserved 2 Unbroken on Outer 3 Present on Sample 2 Arriblent or Chillod NOTES: WESTON Analytics 3 Roceived Brokery 1 Present on Outer Z 1 Shipped or Hand-Delivered Z 5 Received Within Package Y COC Record Wet: of Samples Y Holding Times Package Y Samples Ware: COC Tape Was: NOTEC NOTES: Use Only NOTES: NOTES NOTES: TIm. Date SAMMES Received by Relinsuished by AND IN COLUMN STREET, LANCORD SOOF/GAK. T-1812 TE 3 Iten/Resson ₹*1811-16* 11/18 4/2/89 Containera/Course ANALYSES PEROUESTED Collected #/Type Containst Oat. Refrigerators Presarvative Time Matrix 4 Q Q Q Q Special Instructions: Date AFW CONTACT & TABASSA M. MAZELERA TIBSM FIELD BANK TIBSSRI SPIKE RIDSATE TIBSSRZSPIKE RINSATE 02-12-51 Received by Client ID/Description Willer DL - Drum Llquids DS - Drum Scilds Work Order 22-81-08-02 T18 SM W Relinguished by X-Other MEDICA AMMYRES USE UNIN F-Flat eea my 6068 Client 1/2017HAMA. Client Contect/Phone_ 0.0 A. A⊈ Hem/Reason NA Use Only SE - Sediment 600 9 フロジ 1000 93 50 - 3olid 3.

EXP-EXPLOSIVES

RFW 21-21-001/A-5/83

7-115

NESTON ARREYTEDS EXPEDSIVES

DATA BUHHARY

Units Rucknehme acted this Againaiyet
Reviewed 98/7/89 Analytical Lot
Date Prepared
Date Analyzed Notes Data is corrected for dilucion, RFW Batch GA/Oc 9/7/59 HARTENEDIE Hatrix: Kinsott installation

Tet Surphy Oc

Sout @ Chows

Dre

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Conment:

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	بر ناء بد			 	- fr	C15/	75%	7) 6-4	L-;	7/5:	1/2 1/	1/5.09		7/5-7	
	म् जिस्स् जिस्स			 	1745	5 T41	7572	7847	L.bc - 0.44	<u>\$</u>	1356	3 2 -	130.3 130.3	27.4	
9	אוקפן	-	_		क्ष्राध्य	(12.7	8.6)	6.95	તું.ડ>	07.h>	9.95>	(19.2	(d. 0)	7 h>	
R	र्याल किल्पास रामदा ४०।		-		मार्थान प्राप्त के प्राप्त कर	1,35 7,35	<u> </u>	11.5	1501	. א כיני,	1001.	14 26 47	2.18 110%	1,000 1	
	Benk Rust		-		12 July	262.0>	84.03	50.1>	(0.295	ak 0>	ري ده (ع. ده	40.96.	ac.0>	12.0>	
MATRIK	LAB ID	•	Dilucion		Shall	HEAX	RDX	1,3,5-TNB	1,3-bi.B	AH .	Tecryl	2, 4, 6-THE	2,6-DNT	2, 4 -Dict	

WESTON ANALYTICS EXPLOSIVES

DRITA BUHHARY

Analytical Lot Date Prepared Date Analyzed

Units Restasted, wipe Teld of Analyst -- Acs

9 । न हर

@ G hours " \$00\$ Fre Test Samples Note: Data is corrected for dilution, ' RFW Batch 8409 HW-033
Installation HWERENE
Hatrix: Kinsalt, wifet 4-10 Comment:

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किंग पर गरमन् वर्षः गरमेन मह	The 14 To	F	100	"Etal ug-	126 m	45 m	
h430	१०६भ५	\		(12.7	5.69>	र्भः	,
2	2	74	20300	45.7 3	9 ⁻ ይከን	0.44.0	
30.51	/			6.00>	4105	501>	
12:40				₹2·9b.	2.ps.>	s-be?	
al. 1 1				रत्य उट	<,21.0	0.167	
(8.0	1		·	(50.0	4250	(250	
sh /	bh	45	90	1830 (19.2	1500	3785 0	
(4.0	7			44.0	رعه	97)	
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-9/1. 9/1	4/1	3	4/2	4	4	216	

nor F. Willrow, ILC. Librailla Laboratory

CLIMIT: USATHAMA - HWAAP

JAMELIS AZCZIVAD: 09-20-39

227 1: 8909L304 - WIPES

7.3. 3: 2231-03.02

Eurlosiys Darratiys

Samples have been prepared and analyzed according to USATHAMA Method LW02. Explosives in Soil, modified for the analysis of wipe samples.

following QA/QC control samples have been The analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLX = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

33 Designates sample spiked with target compound.

GEE Designates sample spiked with target compound in duplicate.

מ Indicates duplicate analysis of a sample.

213 Not spiked.

Diluted below calibration range. DL

G Indicates elevated detection limit due to sample interference.

XX Not reported.

NOTE: Spikes have been reported as result (3

racovery).

Data Qualifiers

< = Lass Than

> = Greater Than

Analysis Summary

Samples Collected: 09-18-89 Samples Prepared: 09-22-89 Samples Analyzed: 09-22-89

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Cartar Nulton, Ph.D.

Vice President/Laboratory Manager

Lionville Analytical Laboratory

HESTON ANALYTICS
ENFLOSIVES IN WIPE SAMPLES DATA SUHMARY

Al T1855Kl T1855Kl W3 008 008 069 1 1 1 1 1 1 1 1 1 1 2.7 < 12.7 < 9.80 < 20.9 < 20.9 < 5.90 < 5.90 < 14.56 < 50.0 < 19.2 < 4.00 < 4.00 < 4.20	RFW Batch Number: 8909L804	8909L804	CLIENTS	USAT	USATHLMA-HWAAP	HAAP		!		i			Faye: 1
TD NALLS W1 WALLS BL W1 G0P W2 W3			TIBEC	1 1 1	TIBEC		T. BOSS	-	T1855R	-	TIBSSE	7	TISSERI
D.F. 1	Sample	I GI	WALLS	HI	WALLS	BL	WI TOF	_	W2		CH		73
Total ug Total ug Total ug Total ug Total ug cotal ug Total ug Total ug Total ug Total ug Total ug Total ug cot	Information	RFW	005		900		00.7		800		600		010
Total ug Total ug Total ug Total ug Total ug ' 12.7		D.F.:	7		~		~		-				-1
4 12.7 4 12.7	•	Unite:	Total	6n	Total	бn	Total	пg	Total	nd	Total	5n	Total ug
9.80 < 9.80		を表現のである。 19 10 10 10 10 10 10 10 10 10 10 10 10 10	< 12.7		12.7	ď	12.7	V	12.7	V	12.7	*	12.7
20.9 < 20.9	RDX		< 9.80	٧	9.80	•	9.80	٧	9.80	V	9.80	٧	9.80
6 3.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.90 6 5.20 7 5.20	1.3.5-TMB.		< 20.9	v	20.9	•	20.9	v	20.9	V	20.9	v	20.9
4.20 < 23.8G	1.3-DNB.		> 5.90	v	5.90	٧	5.90	v	5.90	V	5.90	Α.	3.90
6 50.0 6 50.0 6 50.0 6 6 19.2 6 19.2 6 19.2 6 6 4.00 6 4.00 6 4.00 6 4.00 6 6 4.20 6 4.20 6 4.20 6 4.20 6	NITROBENZENE		< 4.20	V	4.20	•	23.86	v	14.56	•	6.72G	٧	6.416
<pre>< 19.2 < 19.2 < 19.2 < 19.2 < 19.2 < 19.2 < </pre>	TETRYL		< 50.0	v	50.0	•	50.0	٧	50.0	V	50.0	٧	50.0
	2.4.6-TNT		< 19.2	v	19.3	V	19.2	V	19.2	V	19.3	v	19.2
< 4.20 < 4.20 < 4.20 < 4	2.6-DNT		4. 00	¥	4.00	•	4.00	V	4.00	V	4.00	٧	4.00
	2,4-DNT.		< 4.20	v	4.20	•	4.20	v	4.20	•	4.20	٧	4.20

	Client	TI	1855R1	,	TIBSSRI	R1	T18.	T18SSR1		TIBSSRI		T1888	~	T185HW1	12
Sample Information R	REW#:	2	011	Ę	210		- ö	013		014		FISED BE	1	POSTTEST 016	Test
J	D.F.: Units:	J.	1 Fotal ug	776	1 Total ug	6n	Tota	1 Fotal ug	_	1 Total u	ng	1 Total ug	מ	Total	51
			2.7		12.7		12.	7	-	12.7	i v	10.7			
RDX	•		. 80	V	9.80	•	9.80	. 0	'	9.80	′ ∨	9.80	•	08.6	_
1,3,5-TNB	•	7	6.0	v	20.9	•	< 20.9	6	٧	20.9	V	20.9	•	20.9	
1,3-DNB	•	S	.90	٧	5.90	•	< 5.90	90	٧	5.90	~	5.90	•	5.90	
NITROBENZENE	•	< 13	.76	V	5.300		< 4.20	20	V	4.20	v	26.96	•	69.50	
TERRYL	•	A U	50.0	V	50.0	•	ς 50.	0	V	50.0	v	50.0	•	50.0	_
2, 4, 6-TNT	•	7	19.2	V	19.3	•	. 19.	ď	V	19.2	V	19.3	•	19.2	
2,6-DMT	•	*	09.	∨	4.00	•		00	V	4.00	v	4.00	•	70.4	_
2,4-DNT	•	▼	.20	v	4.20	•		20	٧	4.20	٧	4.20	•	4.20	_

WESTON ANALYTICS

SUMMARY
DATA
SAMPLES
HIPE
IH
EXPLOSIVES

RFW Batch Number: 8909L804	9L804	CLIENT: USATHAMA-HUAAP	THAMA-HUAAP	RFW Batch Number: 8909L804 CLIENT: USATHAMA-HWAAP	A 60.094
		T185H	1 1 2 3 3 4 4 4 4 1 1	: 	
Sample	: QI	FIELD BL			
Information	****	017	BLANK	5X28	90 X Q E
	D.F.:		-		-
	Unita:	Total ug	Total ug	Total ug	Total ug
	4	经通知银行经济的复数 医二苯甲甲甲苯甲甲甲	电影电影电影电子电影器		
HMX.	• • • • • • • • • • • • • • • • • • • •	< 12.7	< 1.27	1.91(74.24)	9.37(71.11)
RUX	• • • • • • • • • • • • • • • • • • • •	08.6 >	< 9.80	1.62(81.64)	7.68(77.7%)
1,3,5-TdB	• • • • • • • • • • • • • • • • • • • •	39.6	< 2.09	3.19(75.28)	16.4(77.4%)
1,3-DMB	• • • • • • • • • • • • • • • • • • • •	. 5.90	< 0.59	0.98(82.2%)	4.84(87.5%)
NITHOBENZENE		< 4.20	< 0.42	0,74(87,7%)	3.64(87.78)
TETRYL.		< 50.0	< 5.00	6.82(67.68)	37.1(73.48)
2, 4, 6-TMT	•••••••••	< 19.2	< 1.92	3.25(83.64)	14.8(76.34)
2,6-DWF.		· 00.4 >	0.40	0.59(72.9%)	2.95(73.18)
2,4-DNT		< 4.20	< 0.42	0.68(80.7%)	3.40/KG GB)

	Client	1
Information	RFW	OXSSD
	D. F. :	e-4
	Unite:	Total ug
IMX		8.14(63.54)
RDX	•••••••	6.94 (70.2%)
1, 3, 5-TMB		14.8(70.01)
1,3-Did		4.44 (74.98)
NITROBENZENE.		3.47(82.2%)
TERMIN.		30.9(61.24)
2, 4, 6-THT.		13.1(67.64)
2,6-DMT		2.75(68.4%)
2,4-DMT	• • • • • • • • • • • • • • • • • • • •	3.10(73.24)

ROY P. WESTON, INC. Lionville Laboratory

CLIZMT: USATHAMA - HWAAP

SAMPLES RECEIVED: 09-20-89

RF# 4: 8909L803 - RINSATES

W.O. #: 2281-08-02

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LWO2, Explosives in Soil, modified for the analysis of rinsates.

The following QA/QC control samples have been concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

D

Description

ELK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

38 Designates sample spiked with target compound. SSD Designates sample spiked with target compound

in duplicate. Indicates duplicate analysis of a sample.

MB Not spiked.

DL Diluted below calibration range.

G Indicates elevated detection limit due to sample interference.

MR Not reported.

NOTE: Spikes have been reported as result (1 recovery) .

Data Oualifiers

< = Less Than

> = Greater Than

Analysis Summary

Samples Collected: 09-18-89 Samples Prepared: 09-22-89 Samples Analyzed: 09-22-89

Carter Nulton, Ph.D.

10-13-89

Vice President/Laboratory Manager Lionville Analytical Laboratory

NESTON ANALYTICS EXPIDSIVES IN RINSATE DANA SUBHARY

NYW Bitch Number: 89091303	i		CLIENT: USATHARA HHAAP	TRSI	HEMA H	HARP							E source
		Cliant Th	TIECP	n a	T18P31	1	TISPBI		11811 Fa		Takuli.		
Information		RENE	007	1	003		400		000		900		7 200
		D.F.: Unita:	Total	ng.	1 Total ug	бn		uç.	rotal ug	u.j	Total ug		actual tes
			V	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	318	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	318	Y	318	V	316	y	316
KDX	•	• • • • • • • • • • • • • • • • • • • •	< 245	V	245	v	245	v	245	٧	245	v	245
1,3,5-2'MB	• • • • • • • • •	• • • • • • • • • • • • • • • • • • • •	< 523	V	523	v	523	v	523	٧	523	V	523
1,3-DNB	• • • • • • •	• • • • • • •	< 148	V	148	v	148	v	148	v	148	V	148
NITHOMENZENE	• • • • • • • • • • • • • • • • • • • •	•	< 105	·-	105	v	105	v	105	٧	105	À	105
TETRVI.	• • • • • • • • • • • • • • • • • • • •	• • • • • • •	< 1250	V	1250	v	1250	v	1250	v	1250	v	1250
2,4,6-TMT	• • • • • • • •	• • • • • • • • • • • • • • • • • • • •	166		480	٧	480	Y	460	v	460	¥	a Co
2,6-DNT	• • • • • • • • • • • • • • • • • • • •	• • • • • • • •	> 100	v -	100	v	100	v	100	v	100	~	100
2.4-DNT.	•	•	< 105	V	105	v	105	v	105	v	105	٧	100

	11111					** ** ***			1	111111	111111111
C11	ent	TIBSHR	-4	TIESHA	럱	T16.3H	=	TIBSH	7	T'I being	
	••	R1		R2		K.3		X		LIELD	10
ation RF		800		600		010		011		612	
ů	··	-		-		-		7		-	
Iun	t.:	Total ug	6n	Total ug	ng	Total ug	En	Total ug	бn	Total ug	ig.
haix	Y ::	318	~	318	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	318	1 V 1 1	318	\ 	318	and her age disp date date with and her it
KDX	v ::	345	v	245	V	245	٧	245	V	in P	
1, 3, 5-Tab	> ::	523	v	523	v	523	V	523	•	523	
1,3-Dida	*	148	v	148	v	148	v	148	v	148	
NITHOBENZERE	v ::	105	v	105	v	105	v	105	v	105	
TREKYE	v ::	1250	v	1250	v	1250	v	1250	V	1250	
2,4,6-FMT	> ::	480	v	480	v	480	v	480	٧	400	
2,6-DNT	v ::	100	v	100	v	100	v	100	V	100	
2,4-DNT	v ::	105	v	105	V	105	~	105	•	105	

WESTON ABALYTICS EXPLOSIVES IN RIHSATE DATA SUMMARY

Krw Batch Number: 89091803 CLIENT: USATHANA HWAAP	91803		CLIENT: USATHANA HWAAP		10 TO THE
	Client				The state field visit field show it? I dish that and and that then two Ca.)
Sample Information	ID ::	DIANK	2XSS	LOKSS	
	D.F.:	100	## ## ## ## ## ## ## ## ## ## ## ## ##	: : : : : : : : : : : : : : : : : : :	
erkeren er en	7	798.798			
нях	•			11.1(86.4%)	Albert date with the ball with the second se
KDX.	••••••••••	< 0.98	1.89(95.18)	8.74(88.4%)	
1, 3, 5-PMB	• • • • • • • • • • • • • • • • • • • •	< 2.09	3.63(85.64)	18.7(88.6%)	
1,3-DMB	••••••••••	< 0.59	1.10(52,48)	5.44(91.7%)	
NITROBENZENE	•••••••••	< 0.42	0.83(97.61)	4.11(97.4%)	
TETRYL	••••••••	< 5.00	8.35(62.78)	44.8(88.8%)	
2, 4, 6-TMT	••••••••••	< 1.92	3.77(97.18)	17.6(90.64)	
2,6-DMT	• • • • • • • • • • • • • • • • • • • •	< 0.40	0.68(83.4%)	3.42(84.53)	
2,4-DMT	• • • • • • • • • • •	< 0.42	0.78(91.9%)	3.97(93.8)	

	Client	Client
Sample	: qı	
Information	REUS	10XSSD
	D. Y. :	-
	Units:	Total ug
	计电子分词 计分别分类 医甲状腺 医甲状腺 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医甲状腺素 医多种原理 医多种原原理 医多种原理 医多种原原理 医多种原理 医多种原理 医多种原理 医多种原理 医多种原理 医多种原理 医多种原理 医多种原理 医多种原理 医多种原原性 医多种原理 医多种原理 医多种原原理 医皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤皮肤	医性性囊膜 医医皮肤性 医乳球性 化二苯甲甲基苯甲甲苯甲甲甲苯甲甲苯甲甲苯甲甲甲甲甲甲甲甲甲甲甲甲甲甲甲甲甲甲甲甲
		(40 64) 5T &
E STATE		17.6(83.1%)
1,3-DNB		5.15(86.84)
NITROBENZENE		3.97(94.04)
TETRYL		41.6(82.3%)
2, 4, 6-TNT		16.4(84.7%)
2,6-DivT		3.29(81.5%)
2,4-Divr		3.77(84.0%)

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Mor 7. Minton, INC. Lionville Laboratory

Cultum: USATHAMA - HWAAP

JAMPARS RECEIVED: 09-20-89

227 \$: 8909L303 - SOIL

W.O. 4: 2231-08-02

Berlosias Barramas

Samples have been prepared and analyzed according to USATHAMA Method LWO2, Explosives in Soil.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Mobreviation

Description

Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

38 - Designates sample spiked with target compound.

ESD = Designates sample spiked with target compound
in duplicate.

D = Indicates duplicate analysis of a sample.

WS = Not spiked.

DL - Diluted below calibration range.

G = Indicates elevated detection limit due to sample

interfarence.

IR - Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Cualifiers

< = Lass Than

> = Greater Than

Analysis Summary

Samples Collected: 09-18-89 Samples Prepared: 09-22-89 Samples Analyzed: 09-22-89

Cartar Nulton, Ph.D.

10-13-89 Date

Vice President/Laboratory Manager Lionville Analytical Laboratory

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WESTON ANALYTICS EXPLOSIVES IN SOIL DATA SUMMARY

NFW Batch Number: 8909E803		CLIEHT: USATHAMA-HWAAP	SATH	HILLIA-HWARE	al	
Client	Client	TISCP				1 1 1
Sample Information	ID :	SOLID	_	BLANK	2XSS	16x38
	D. F. :	~		-	ન	~
	Units:	ad/a		Total ug	g Total ug	Total ug
		1.27		1.27		11,8(52.6%)
KDX	•	0.98	٧	96.0	2.18(1114)	8.89(90.7%)
1.3.5-TMB	•	< 2.09	v	2.09	4.58(110%)	20.4(97.5%)
1 3-DMB	•	< 0.59	٧	0.59	1.36(115%)	5.85(99.34)
NITROBENZERE	•	< 0.42	٧	0.42	0.92(110%)	4.12(98.4%)
TETRYL	•	< 5.00	Y	5.00	11.3(1138)	48.8(97.5%)
2.4.6-EM.	•	< 1.92	٧	1.92	4.63(120%)	15.6(97.18)
2.6-DHT.	• • • • • • • • • • • • • • • • • • • •	< 0.40	V	0.40	0.90(112%)	3.52(97.7%)
2 4-DWP		< 0.42	٧	0.42	(8771)750	4.11(97.68)

	Client	1
Sample	ID :	
Information	2年2年2	10XSSD
	D.Y.:	-4
	Unita:	Total ug
医多种性 医多种性 医水性 医水性 医神经 医神经 医生物 医生物 医生物 医生物 医生物 医二甲基苯甲基甲基苯甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲		医神经神经 化二甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基
Time and a second secon	• • • • • • • • • • • • • • • • • • • •	13.4(105%)
KDX		10.0(102%)
1,3,5-Tilb		22.5(1084)
1.3-DIMB.	• • • • • • • • • • • • • • • • • • • •	6.48(110%)
NITROBENZENE		4.56(1098)
TETRIE:	• • • • • • • • • • • • • • • • • • • •	55.5(1118)
2,4,6-TiT.	• • • • • • • • • • • • • • • • • • • •	20.8(108%)
2,6-DNT	• • • • • • • • • • • • • • • • • • • •	4.31(1084)
2,4-DNT.		4.50(1078)

nor 7. MESTON, INC. Licavilla Laboratory

COLINY: USATHAMA - HAWTHORNE 2332228 RECRITED: 09-22-89

277 3909L351, RINSATES

ു.ാ. ≱: 2231-03-02

HITCOSTYS MARRATTYS

Samples have been prepared and analyzed according to USATHAMA Hethod LW02, modified for the analysis of rinsates.

following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbraviation

Description

BLX = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

38 Designates sample spiked with target compound.

SSD Designates sample spiked with target compound in duplicate.

 \mathcal{Z} Indicates duplicate analysis of a sample.

لنالا Not spiked.

DL Diluted below calibration range.

G Indicates elevated detection limit due to sample interference.

XX Not reported.

NOTE: Spikes have been reported as result (3

racovery) .

Data Qualifiers

< = Less Than > = Greater Than

Analysis Summary

Samples Collected: 09-20-89 Samples Prepared: 09-26-89 Samples Analyzed: 10-24-89

Cartar Nulton, Ph.D.

Vica President/Laboratory Manager

Lionville Analytical Laboratory

WESTON ANALZTICS EXPLOSIVES IN RINSATE DATA SUBMARY

KFF Batch Number: 8509L851		CLIENT:	USATHAMA-HAWI'HORNE		
o Comp	Client	T18 MOTOR			er de l'est
Information	RFH	30AN 1E31 001	2X7S	lokes	
	D.¥.0	1400	-	-	
Units:		Total ug	Total ug	Total ug	
ikiX	•	220	2.43(94.4%)	13.1(1028)	
RDX	• • • • • • • • • • • • • • • • • • • •	< 170	1.82(92.0%)	10.1(1024)	
1, 3, 5-138	*	< 370	4.02(94.84)	21.6(102%)	
1,3-Didb	· · · · · · · · · · · · · · · · · · ·	100	1.14(95.84)	6.05(102%)	
Nitrobenzene	• • • • • • • • • • • • • • • • • • • •	< 74	0.79(94.54)	4.35(1034)	
Tetryl	• • • • • • • • • • • • • • • • • • • •	880	6.47 (64.04)	46.4(91.9%)	
2,4,6-INT	· · · · · · · · · · · · · · · · · · ·	c 340	2.72(69.9%)	17.4 (39.6%)	
2, 6-DMr	· · · · · · · · · · · · · · · · · · ·	70	0.85(106%)	4.24(105%)	
S. 4-Did.	• • • • • • • • • • • • • • • • • • • •	20	0.82(96.4%)	4.34(103%)	

o.	Client	!	211
Sample	: qI		
ation	KFW#:	10X8SD	BLANK
	D. F. :	m	
ğ	Unite:	Total ug	Total ug
化甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	e 7 # 7 K Z Z		() 如 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
MAX	•	12.5(97.2\$)	< 1.27

HMX	12.5(97.2%)	٧	< 1.27
XDX	9.74 (98.6%)	'	83.O
1, 3, 5-T.B.	21.1(99.6%)	~	2.09
1,3-DMB	5.90(99.5%)	٧	< 0.59
Microbengene	4.25(101%)	V	0.12
Tetryl	42.8(84.8%)	'	5.00
2, 4, 5-mr	15.5(79.9%)	' v	1.92
2, 6-DMT.	4.16(103%)	· •	. 0.40 <
2,4-DMf	4.23(160%)	' v	< 0.42

MIT. TECHNIA, IIC. Lionville Laboratory

TILLE

SAMPLAS RECEITED: 01-25-90

T. 2 4:

20011325-Wipes

7.0. j: 2231-03-02

ROUGSING DARRATOR

Samples have been prepared and analyzed according to USATHAMA Mathod LWO2, Modified for the analysis of wipe samples.

following CA/CC control samples have been concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Cascription

MI = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide pracision and accuracy data.

SS Designates sample spixed with target compound.

SSD Designates sample spiked with target compound in duplicata.

D Indicates duplicate analysis of a sample.

:15 Mot spiked.

DL Diluted below calibration range.

G Indicates elevated detection limit due to sample

interference.

K Not reported.

NCTE: Spikes have been reported as result IBCOVERY).

Cata Cualifiars

< = Less Than

> = Greater Than

Analysis Susanry

Samples Collected: 01-26-90 Samples Prepared: 01-30-90 Samples Analyzed: 01-30-90

Carter Nulton, Ph.D.

Data

Vice President

Lionville Analytical Laboratory

Roy F. Weston, Inc. - Lionville Laboratory REP AMALYTICAL DATA PACKAGE FOR USATHAMA-HWAAP

DATE RECEIVED: 01/26	/90		RFW LOT # :9001L326
CLIENT ID	NY MI	PREP # COLLECTION	IXTR/PREP ANALYSIS
T13 CLAY PIPE POST T	001 WI	01/26/90	•

WESTON ANALYTICS NIPE EXPLOSIVES DATA

	'D	CLIENT:		HRAAP		20 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Client	i	i 			
Sample		CLAYPIPE	PE			
Information	10:	POST T				
	RFW#:	100		BLANK	2XSS	10XSS
,	D. F. :	10		-	-	KĀ
	Units:	Ĕ	5n	Total ug	Total ug	rotal ug
,		_	'	12.7 < 1.27	2.18(86.81)	11.6(50.18)
xux	• • • • • • • • • • • • • • • • • • • •	> 9.80	. V	0.98	1.71(87.18)	8.86(96.3%)
., 3, 5-TMB	• • • • • • • • • • • • • • • • • • • •	< 20.9	v	5.09	3.63(91.2%)	19.8 (94.3%)
1,3-548	• • • • • • • • • •	< 5.90	٧	0.59	1.07(96.7%)	5.86(99.38)
NITHODENZENE	• • • • • • • • • • •	< 55.4	٧	0.42	1.08(93.71)	4.83(115%)
ETHYL	• • • • • • • • • • •	< 50.0	v	2.00	8.94(94.63)	49.5(58.95)
2, 4, 6-1Mf		< 19.2	v	1.92	3:63(98.3%)	19.7 (1208)
2,6-DNT	• • • • • • • • • •	× 4.00	v	0.40	0.73(89.2%)	3.90(97.54)
	• • • • • • • • • • • • • • • • • • • •	< 4.20	v	0.42	0.72(89.9%)	4.00(95.3%)

Client	***
Sample :	
Information	
1. 東京山路	19XSSD
D.F.:	
Units:	Total ug
· 医有电话 计记录电子 医牙唇部周旋性 经总统 医电视性静脉 计可引擎电路设计器	P. P. P. P. P. P. P. P. P. P. P. P. P. P
helx	11.7(91.28)
NDX	9.00(91.28)
1,3,5-1.166	20.1(95.9%)
1,3-E/B	5.66(99.3%)
WITHOUSENZENE	4.55(1084)
TETALL	49.0(58.0%)
2, 4, 6-TNT	19.3(1184)
2, 6-DkT	3.77(94.18)
2,4-Davr	3.92(93.94)

MCY 7. MINITEN, INC. Libraille Laboratory

CLIEBT: HMAAP

SAMPLES RECEIVED: 01-26-90

327 3: 3001L326-6011 I.O. ≱: 2231-08-02

HELICSIUS TARRALIUS

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in soil.

The fullowing QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Cascription

Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

Designates sample spiked with target compound. SSD Designates sample spiked with target compound in uplicate.

Indicates duplicate analysis of a sample.

2E Not spiked.

Diluted below calibration range.

Indicates elevated detection limit due to sample

interference. XX. Not reported.

NOTE: Spikes have been reported as result (\$

racovery).

NOTE: Soil results are reported in a dry weight basis.

Data Cualifiers

< = Less Than

> = Greater Than

Analysis Sussary

Samples Collected: 01-25-90 Samples Prepared: 01-30-90 Samples Analyzed: 01-30-90

Z.h.-/ 12 1 Carter Nulton, Ph.D.

2-12-9-

Vice President

Lionville Analytical Laboratory

Roy 7. Westen, Inc. - Lienville Laboratory REP AUGLITICAL DATA PACKAGE FOR THATHAMA-HWAAP

DATE RECEIVED: 01/25	/30				7278 EXT \$ 190	OUL325
CLIME ID	329 F	M.	28 32 🛊	COLLECTION	exim/prep	EIEYJAM
		******	***************************************			
TIS CLAYPIPE GROUND	002	YY		01/26/90	•	

WESTON ANALYTICS SOIL EXPLOSIVES DATA

KrW Butch Number: 90015326		CLI EWF:	Lighar		A Walter Man
Bample Treformation	C11ent	T 18 CLAYPIPE	## ## ## ## ## ## ## ## ## ## ## ## ##	8 4 2	
All Of Mation	RFG S	2.00kg	BLANK	2XSS	10XSS
	D.F.: Units:	rotal ug	1 Total ug	Total	nd Total uj
Haring and the second s			# -	# *	10.6(63.5%)
KDX			96.0 >	1.70(87.1%)	62(7
1,3,5-THB	• • • • • • • • •		~	•	B) 6.
1,3-Drib	• • • • • • • • • • • • • • • • • • • •	< 0.59	ö	.14 (96.	6 (54.
NITROBENZENE	•	•	ö	•	~
TENNET.	•	< 5.00	•	.46(47.1(94.18)
2, 4, 6-INT		< 1.92	.	3.77(98.38)	18.2(111%)
2,6-DMT	•	< 0.40			3.55(68.78)
2,4-DAT		c 0.42	4.0	0.75(89.94)	3.68(87.7%)
Sample Information	Client ID: RFW#: D.F.: Units:	10XSSD 1 Total ug			
HMX RDX 1, 3, 5-TMB. 1, 3-DiB. NITHOBENZENE TETRYL. 2, 4, 6-TWT. 2, 6-DWT.		10.6(83.3 7.82(79.7 18.86(89.5 5.63(95.5 3.84(91.5 46.6(93.1 18.0(110\$ 3.56(88.9			



ROX 7. MESTON, INC. Libralla Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-16,19,27, 8-1,5,10,15,20,22,29, 9-2,11,20

3909L595,679,304

7.0. 1: 2231-08-02

INORGANIC HARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager

Dishville Analytical Laboratory

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA OUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.

MS - Matrix Spike.

MSD - Matrix Spike Duplicate.

REP - Sample Replicats.

LC - Indicates a method LCS or Blank Spike.

NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix. MAAS - Metals prep test for AA digestion, soil matrix.

MAAS - Metals prep test for AA digestion, soil matrix.

MICW - Metals prep test for ICP digestion, water matrix.

MICS - Metals prep test for ICP digestion, soil matrix.

H**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eq. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC. INORGANICS DATA SUMMARY REPORT 02/20/90

	USATHAMA-HWAAP ER: 2291-08-02-0000		WESTON	BATCH #:	8903L679
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING
-028	Tlasmw2 PRE TEST	NITRATED ESTERS	27.5	UG	20.0
-029	TIBSM FIELD BLANK	NITRATED ESTERS	5.0 u	UG	5.0

i

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	: USATHAMA-HMAAP RDER: 2281-08-02-0000	·	HESTON		8909L679
SAMPLE		ANALYTE	RESULT	נדומט	REPORTING LIMIT
3LANK1		NITRATED ESTERS	2.5 u	MG/L	2.5
SLANK2	0 89LNC012-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HWAAP BOLK ERDER: 2281-08-02-0000 WESTON BATCH #: 8909L67! SPIKED SPIKED INITIAL SAMPLE SITE ID ANALYTE SAMPLE RESULT AMOUNT MRECE NASSERE. 人名英格兰斯西班牙斯西班牙斯斯西班牙斯斯 _______ ******* **** **** NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS 10.1 47.6 48.8 2.5 u 2.5 u 2.5 u 8LASK10 6LASK20 89LNC012-MB1 89LNC012-MB2 10.0 101 9**5**.

50.0 50.0 97.

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP -WORK ORDER: 2281-08-02-0000

WESTON BATCH #: 3909L679

				l SPIKE#:	
SAMPLE	SITE ID	ANALYTE	%RECOV	%RECOV	%DIFF
法事事性知知 3	*************	**************	*****	*****	
BLAMK20	89LNC012-M82	NITRATED ESTERS	35.2	97.5	2.5

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/20/90

CLIENT: US	SATHAMA-HWAAP R: 2281-08-02-0000		WESTON 1	BATCH #:	8909L304
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	T18 SMW2	NITRATED ESTERS	5 C u	UG	5.0
-002	T18 SM FIELD BLANK	NITRATED ESTERS	5.J u	UG	5.0
-003	T18 FLSH CHMB WA W2	NITRATED ESTERS	5.0 u	UG	5.0
-004	T18 FLSH CHMB WA BLN	NITRATED ESTERS	5.0 u	UG	5.0
		•			

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/20/90

	JSATHAMA-HWAAP ER: 2281-08-02-0000		WESTON	BATCH #:	8909L804
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC014-MB1	NITRATED ESTERS	2.5 u	MG/L	2.5
BLANK20	89LNC011-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/20/90

CLIENT: USATHAMA-HHAAP HORK ORDER: 2231-08-02-0000

WESTON BATCH #: 3909L30

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL REPULT	SPIKED AMOUNT	%REC
		******************	******	********	*****	***
BLANK10 BLANK20	39LNC014-MB1	NITRATED ESTERS	10.1	2.5 u		
DEANNEU	89LNC014-MB2	NITRATED ESTERS	49.3	2.5 d 2.5 d		
		NITRATED ESTERS	43.9	4.5 U	50.0	9/

INORGANICS DUPLICATE SPIKE REPORT 02/20/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2291-08-02-0000

WESTON BATCH #: 8909L804

TONK CRUE	.X. 2231-08-02-0000	•	SPIKE#1	l SPIKE#2	,
SAMPLE	SITE ID	ANALYTE		%RECOV	-
*****	*********	******	*****	****	*****
BLANK20	89LNC014-MB2	NITRATED ESTERS	9 9.5	97.7	1.8

APPENDIX G

AMALYTICAL DATA SUMMARY TABLES FOR STACK TEST PROGRAM

1311R2

APTEMIDIE G

Appendix G contains data collected from stack testing that was conducted during T2, T3, and T5. Two types of data are included. The first type consists of raw operational data from the flash chamber inlet, flash chamber outlet, and the afterburner outlet. These data were used to generate Tables 3-6, 8-7, and 3-8 in the main report. The following information is included:

- Flash chamber inlet
 - Test data.
 - Inputs for calculations.
 - CEM report data for total hydrocarbons.
- Flash Chamber Outlet (sheet 1, explosives data)
 - Test data.
 - Inputs for calculations.
 - Laboratory report data for explosives.
- Flash Chamber Outlet (sheet 2, smokeless powder data)
 - Test data.
 - Inputs for calculations.
 - Smukeless powder results from sample train.
 - CEM report data for total hydrocarbons.
- Afterburner Outlet (sheet 1, explosives data)
 - Test data.
 - Inputs for calculations.
 - Laboratory report data for explosives.
- Afterburner Outlet (sheet 2, smokeless powder and particulate data)
 - Test data.
 - Inputs for calculations.
 - Laboratory report data.
 - Particulate catch.
 - Smokeless powder catch.
 - CEM report data for NOx and total hydrocarbons.

The second type of data consists of analytical data summaries generated by the offsite laboratory (WESTON Analytics Division, Lionville, Pennsylvania). The analytical data summaries provide the following information:

• Inorganic narrative (explosives narrative presented, where applicable).

- Glossary of terms.
- Inorganics data summary report.
- Inorganics quality ensurance/quality control (%A/QC) report.
- Explosives narrative.
- Explosives data summary.

The inorganic narrative is generally a summary of the quality control results and a description of any problems encountered during the analysis of the samples. The glossary of terms defines the data qualifiers used in the report, abbreviations, and laboratory chronology and holdtime report codes.

The inorganics data summary presents the actual results of the analysis. In addition, the lab sample number, site ID, analyte tested, and the reporting limit are provided.

The inorganics QA/QC report includes the analysis of a method blank, inorganics accuracy report, and an inorganics duplicate spike report.

STACK TEST 2 400°F/24 HOURS RAW OPERATIONAL DATA

PAYTHORNE PRHY AMMINITION PLANT

Past Data	T1 1	T-9 -2	TZ-3
lun number	T2-1	TZ-2	
Location		FLASH CHAMBER	
2ate	07-25-39		
Time mentod		1720-2200	
Cherator	∪00	-5 0	JD0
Inputs For Calcs.			
ig. rt. selta P	9.430120		0 158260
Celta H	0.75000		0.75000
Stack tamp. (deg.F)	∴30.75	311.37	743.30
Meter temp. (ded.f)	100.00	97.00	99.30
Sample volume (act.)	164.255	143.365	125.322
Barometric press. (in.lig)	26.44	26.44	25.40
Volume 320 imp. (ml)	75.30	50.30	25.0 0
Weight change sil. gel (g)	37.00	39.00	34.00
¥ CO2	1.900	1.300	1.300
¥ 92	17.000	17.000	17.500
ppm CO	131.300		200.300
& N	81.100		80.300
Area of stack (sq.ft.)	1.77		1.77
Sample time (min.)	305.00		250.00
Static pressure (in.H20)	0.06		0.06
Hozzle dia. (in.)	NA	HA	AR
Heter box cal.	0.2991		0.3991
Cp of pitot tube	0.34		0.84
cp of prior tube	4.04	0.04	0.04
Cem Report Data			
Total Hydrocarbon PPM	29.6	39.8	45.6

HANTHORNE ARMY ADMINITION PLANT HANTHORNE, HEVADA

Test Bata Aum number tocation Este Time period Operator		T2-1	OSIVES TEST 12-2 CHAMBER OUTLI 7-25-39 1558-2331 SX/WS	TZ-3 ET 7-25-89 0945-1414 SK/XS
Inputs For Calcs. Sq. rt. delta P Delta N Stack temp. (deg.F) Meter temp. (deg.F) Sample volume (act.) Barometric press. (in.Hg) Volume HZO imp. (ml) Meignt chinge sil. gel (g) % COZ % UZ CO ppm % N Area of stack (sq.ft.) Sample time (min.) Static pressure (in.HZO) Mozzle dia. (in.) Meter box cal. Cp of pitot tube		0.434755 1.10547 345.42 105.74 233.731 25.44 72.50 57.00 1.200 16.200 86.700 82.600 1.77 360.06 -0.44 0.300 1.0020 0.34	0.510594 1.40764 405.99 102.26 324.082 25.31 116.00 64.35 1.190 18.400 92.300 80.600 1.77 445.00 -0.56 0.300 1.0020	0.506651 1.35525 424.35 106.54 171.536 26.40 35.00 37.80 1.100 18.200 122.750 50.500 0.177 240.00 -0.54 0.300 1.0020 0.34
Laboratory Report Data, Total ug				
h i4 X	<	3180.00 <	3180.00	4.18
ROX	•	2450.00 <	2450.00 <	2.45
Trinitrobenzene (1 3 5 TMB)	•	5230.00 <	5230.00 <	5.23
Dinitrobenzene (1 3 DNB)	<	1480.00 <	1480.00	4.46
Ni trobenzene	<	1050.00 *	1050.00 4	1.05
Tetryl	<	12500.00 <	12500.00 <	12.50
2 4 6 Trinitrotoluol (TNT)		70400.00	39600.00	93.50
2 4 Dinitrotoluene (2 4 DNT)	<	1050.00 <	1050.00 <	1.05
2 6 Dinitrotoluene (2 6 DNT)	<	1000.00 <	1000.00 <	1.00

THANK HOLTHHUMBO YM'Y BERDYNNOU ACHT ACHT 145

Tust Data	PARTICULATE TEST				
CLIP TUR DEF	12-1	72-3	72-5		
Cocation		CHANGER SUTLE			
Cate	7-13-39	i5- 39	7-75-19		
Time period	3330-1536	1629-2331	0945-1444		
îperscon	J20/0X	22,13	X/LS		
Irquis For Calcs.					
iq. nt. dalta P	0. 40399	0.301335	3.479036		
Catra H	1.32442	1.30774	1.73563		
Stack temp. (deg.)	343.39	403.75	ند.ت،		
Meter temp. (deg.F)	113.38	103.52	114.74		
Cample volume (act.)	048.042				
Carcaetric press. (in.Hg)	25.44	25.31	25.40		
Volume H2O imp. (ml)	32.00	109.00	52.50		
Veight chage sil. gel (g)	45.00	აგ. ამ	37.00		
% co2	1,200	1,100	1.100		
x 32	16.200	15,400	18.300		
CO COM	36.700	92.300	122.700		
XX	32.500	30.500	20.500		
Area of stack (sq.ft.)	1.77	1.77	1.77		
Sample time (min.)	260,00	420.00	240.00		
Static pressure (in.H2O)	-0.5 0	-0.57	-0.57		
Hozzla dim. (in.)	0.310	0.310	0.310		
Heter box cal.	1.0020	1.0020	1,0020		
Cp of pitot tube	0.34	0.34	0.34		
Smokeless powder					
Total Mitrated Esters, ug	30003.5	13601.49	1591.88		
Com Report Data					
Total Hydrocarbon PPM	23.9	28.9	34.3		

TRANS MOSTINUMEN VERN SHROWTHAN AGAVED AGAVED AGAVED.

Test Cata	EXPLOSIVES TEST						
dun ausoer		T2-1	77-2	~7-3			
ipcation		AFTERSI	_				
iste		7-25-69	7-25-39	7-23-39			
fine period		3829-1537	1540-2340	0945-1444			
in a seriou		34/5X	JH/NS	JA/SK			
FESTALOI		G17 5K	ent un	Olly and			
Imputs For Calcs.							
N. rt. delta P		0.089896	0.103104	0.099647			
Celta N		0.33191	1.01125	0.955208			
		1725.d8	1790.24	1721.35			
Stack temp. (deg. g)		112.41	108.92	114.54			
તુકtar tamp. (૮૭૦.૬)			224.444	144.556			
Sample volume (act.)		157.991					
Birometric press. (in.Hg)		25.44	26.31	25.40			
Colume H2O imp. (ml)		230.00	320.00	175.00			
Weight chage sil. gel (g)		43.20	55.00	31.00			
¥ CG2		7.10 0	6.500	5.000			
* 32		9.300	10.700	11.500			
PPM CO		7.500	6.000	7.00 0			
4 4		83.000	82. 300	82. 50 0			
Area of stack (sq.ft.)		17.10	17.10	17.10			
Sample time (min.)		340.00	360.00	240.00			
Static pressure (in.H20)		-0.10	-0.10	-0.10			
Mozzle dia. (in.)		0.760	0.300	0.300			
Peter pox cal.		0.9953	0.9953	0.9953			
		0.84	0.34	0.84			
Cp of pitat tube		0.04	0.04	J.04			
Laboratory Report Data, Total ug							
1 MX		12.52	2.16 <	1.27			
₽DX	<	0.98 <	0.98	2.92			
Trinitrobenzene (1 3 5 TNB)		5.90 <	2.09 <	2.09			
Dinitrobenzene (1 3 DNB)		0.50	0.24	0.87			
Hi trobenzené	<	0.42 <	0.42 <	0.42			
Tetryl	<	5.00 <	5.00 <	5.00			
2 4 5 Trinitrotoluol (TNT)	*	1.92 <	1.92 <	1.92			
2 4 Dinitrotoluene (2 4 DNT)	<	0.42 <	0.42 <	0.42			
o C Blatama I /B & Bust		2.46	0.40	A 14			
2 S Dinitrotoluene (2 6 DNT)	<	0.40 <	0.40 <	0.40			

WHITECOME ABOV SMERKITECH PLANT SHITECOME, MEVADA

Test Date Tun number		PACKELESS POWDER AND PARTICULATE TEST 72-1 T2-2 T2-5				
Location		AFTERBURNER CUTLET				
Cata		7-25-39	7-33-39	7-25-59		
line period		0830-1537		0945-1414		
Cperator		JM/SK	LA/WS/SK	LM/VS		
Inputs for Calcs.						
fa. nt. delta P		0.399753	0.101708	0.164104		
Called H		1.45147	1.57353	1.13458		
Srack temp. (deg.F)		1663.73	1703.27	1639.71		
Hetur temp. (deg.F)		109.50	105.31	110.23		
Jample volume (act.)		235.749	256,203	151.315		
Barometric press. (in.Ng)		25.44	25.31	25.40		
Yolume H2O imp. (ml)		339.00	340.00	198.00		
Weight chage sil, gel (g)		50.00	56,00	35.00		
X C02		7.10	6.50	6.00		
¥ 02		9.70	10.70	11.50		
PFH CO		7.50	6.20	7.00		
X X		33.00	32.30	82.50		
Area of stack (sq.ft.)		17.10	17.10	17.10		
Sample time (min.)		340.00	360.00	240.00		
Stacic pressure (in.H20)		-0.10	-0.10	-0.10		
Nozzie die. (in.)		0.360	0.360	0.310		
Meter box cal.		1.0030	1.003C	1.0030		
Cp of pitot tube		0.34	0.34	0.34		
Laboratory Report Data						
Front helf acetone, g.		0.0049	0.0018	0.0024		
Filter catch, g.		0.0025	0.0018	0.0020		
Total perticulate catch,g.		0.0074	0.0036	0.0044		
Smokeless powder						
Nitrated Esters	<	1805 <	1660 <	1447		
Cam Report Data						
NOX PPH		58.9	54.6	54.8		
Total Hydrocarbon PPM		0.2	0.0	0.3		

STACK TEST 3 500°F/36 HCURS RAW OPERATIONAL DATA

PARTUCANE RAMY AMUNITION PLANT CARTICANE, REVACA

Test Sata			
itun tumber	73-1	T3-2	T3-3
location	· · · · · · · · · · · · · · · · · · ·	LASH CHAMBER	INLET
3ate	07-17-39	07-17-09	J7- (3-3 9
Time perfod	0450-1206	1449-1900	1440-2100
Operator	uD 0	LD0	UD 0
Inputs For Calcs.			
Sq. rt. Jelta P	0.489900	0.529150	0.524400
Delta H	1.30300	0.75000	0.70000
Stack temp. (deg.F)	1123.80	1030.30	933.20
Reter temp. (deg.F)	110.00	100.00	103.00
Sample volume (act.)	238,741	127.321	190.399
Barcmetric press. (in.lig)	25.48	25.04	25.97
Volume H2O imp. (ml)	115.00	50.0 0	50.00
Meight chage sil. gel (g)	20.00	23.00	47.00
* CO2	2.400	2.200	1.300
* 02	15.300	16.50 0	16.700
ppm CO	9.300	55.50 0	113.500
* }	81.300	31.300	81.500
Area of stack (so.ft.)	1.77	1.77	1.77
Sample time (min.)	436.00	251.0C	380.00
Static pressure (in.H20)	0.06	0.06	0.06
Nozzle dia. (in.)	NA	NA.	AK
Heter box cal.	J. 9991	0.3991	0.9991
Cp of pitot tube	0.34	0.34	0.84
Cem Report Pata			
Total Hydrocarbon PPM	49.0	33.1	38.2

DESTROPHE ARMY AMBURITION PLANT HANTHORNE, REVACA

řest Data	EXPLOSIVES TEST				
Run number		T3-1	73-2	T3-3	
Location			CHAMMER CUTL		
date		7-17-39	7-17-39	71339	
Time period		0445-1225	1439-2221	1433-2134	
Cperator		JD0/9S	JDC/SK	JD0/NS	
Inputs For Cales.					
Sq. rt. delta P		0.461140	0.442933	0.502224	
Celta H		1.03389	0.32759	1.202.9	
Stack temp. (deq.F)		440.22	510.21	512.69	
meter temp. (ded.f)		95.24	113. ↓8	111.32	
Sample volume (act.)		229.737	146.367	243.272	
Barometric press. (in.Hg)		25.48	25.94	25.97	
Volume H2O imp. (ml)		100.00	74.00	124.00	
Weight chage sil. gel (g)		56.00	31.00	49.00	
\$ CO2		1.400	1.300	1.100	
¥ 02		17.200	17.500	17.500	
00 K99		19.000	100.400	169.000	
N H		31.40 0 1.77	81.200 1.77	81.300 1.77	
Area of stack (sq.ft.)		360.00	240.00	360.00	
Sample time (min.) Static pressure (in.H2O)		-0.48	-0.48	-0.56	
Nozzle dia. (in.)		0.300	0.300	0.300	
Reter box cal.		1.0020	1.0020	1.0020	
Cp of pitot tube		0.84	0.84	0.84	
op ». p 555 556		• • • • • • • • • • • • • • • • • • • •			
Laboratory Report Datc, Total ug					
HMX	<	3180.00 <	31.80 <	12.70	
ROX	<	2450.00 <	24.50 <	9.80	
Trinitrobenzene (1 3 5 TNB)	<	5230.00 <	52.30	21.70	
Dinitrobenzene (1 3 DNB)	<	1480.00 <	14.80 <	5.90	
Mitrobenzene	4	1050.00 <	10.50	22.00	
Tetryl	<	12500.00 <	125.00 <	50.07	
2 4 6 Trinitrotoluol (THT)		89200.00	64.20	171.00	
. 2 4 Dinitrotoluene (2 4 DNT)	∢	1056.00 <	10.50 <	4.20	
2 6 Dinitrotoluene (2 6 DNT)	<	1000.00 <	10.00 <	4.00	

THE ACTION DESCRIPTION DESCRIPTION OF THE PROCESS O

7-st Data	PARTICULATE TEST					
Un Juneer	13-1 3-2 n					
Lucation	<i>さ</i> しんより	T				
)4 ca	7-17-19	7-17-39	7-13-79			
Tipa perfod	0445-1 <u>22</u> 3	1441-2221	1424-2124			
Corator	∍0C/¥S	JX/SX	_X/VS			
Inputs For Calcs.						
ig. nt. dalta P	0.453053	0.447826	0.460654			
Deits N	1.42324	1.13292	1.:387			
itaax tamp. (deg.f)	440.39	507.35	498.24			
Setor temp. (deg.f)	103.47	112.31	113.28			
Jample valume (act.)	240.253	156.330	240.406			
Jarometric press. (in.dg)	26.48	35.74	25. 7			
Volume 320 imp. (ml)	107.30	75.00	128.00			
Weight change sil. gel (g)	40.30	33.00	46.00			
2 002	1.400	1.300	1.100			
% 3 2	17.200	17.500	17,300			
PEM CO	19.000	100,400	169.000			
K X	81.460	31.200	81.300			
Area of stack (sq.ft.)	1.77	1.77	1.77			
Sample time (min.)	370.00	240.07	360,00			
Static pressure (in.H2M)	-0.48	-0.50	-0.52			
Nozzie die. (in.)	0.310	0.310	0.316			
Neter box cal.	1.00 20	1.0020	1 CO20			
Cp of pitot tube	0.34	0.34	0.34			
Smokeless pouder						
Nitrated Esters	35692.58	3099.38	7703.13			
Cam Report Data						
Total Hydrocarbon PPM	33.9	27.8	27.9			

HANTHORNE ARMY AMMUNITION PLANT HANTHORNE, NEVAGA

Test Bata Run number		נגס 1-בז	LOST	/ES TEST T3-2		73-3	
Location		AFTERBURNER OUTLET					
3468		7-17-39		17-39		7-13-39	
fine period		445-1225		10-2221		1433-2134	
Operator		CH/HS		AZ/K		JA/XS	
Imputs For Calcs.		0.000422		.084823		0.096900	
Sq. rt. delta P		0.090423	,	0.54542		0.090900	
Pelita H		1813.47		1802.19		1306.30	
Stack temp. (deg.F)		28.33		115.21		118.50	
Metar tomp. (deg.F) Sample volume (act.)		174. 486		112.964		191.591	
Barchetric press. (in.Hg)		25.48		25.94		25.97	
Volume H2O imp. (ml)		275.00		185.00		310.30	
Weight change sil. gel (g)		42.00		25.00		43.00	
* CO2		6.500	-	5.700		6.200	
k 02		10.300		11.000		11.200	
การกับนั้น การกับนั้น		4,900		1.300		6.600	
4 8		83.200		82.300		82.500	
Area of stall (sq.ft.)		17.10		17.10		17.10	
Sample time (min.)		360.00		240.00		360.0 0	
Static pressure (in.H2O)		-0.10		-0.10		-0.10	
Mozzie dia. (in.)		0.760		0.760		0.760	
Heter box cal.		0.9953		0.9953		0.9953	
Co of pitot tube		0.34		0.84		0.34	
Laboratory Report Data, Total ug							
HMX .	<	1.27	<	1.27	<	1.27	
XCS		3.81		3.82		2.80	
Trinitrobenzene (1 3 5 TNB)	<	2.09		3.46		2.78	
Dinitrobenzene (1 3 DNB)		5.60		8,40		5.17	
Nitrobenzene	<	0.42		20.20	<	0.42	
Tetryl	<	5.00	<	5.00	•	5.00	
2 4 6 Trinitrotoluol (TNT)	<	1.92	<	1.92	<	1.92	
. 2 4 Dinitrotoluene (2 4 DMT)	<	0.42	<	0,42	«	0.42	
2 5 Dinitrotoluene (2 6 DNT)	<	0.40	<	0.40	<	0.40	

JANTHORNE JANY SAMENITION PLANT

Test hate An number Location Date Time period	73-1 AFTI 7-17-39 3445-1226		13-3 7-13-19 1424-2124
Sparator	JH/WS	JX/SK	JA/VS
Inputs for Cates.			
Gq. nt. Gelta P	0.373102	0.834311	0.087440
Delta 3	0.33597	1.37917	1.12131
Ctack temp. (deg.F)	1747.29	1300.35	1739.20
Heter temp. (ಡಲ್ಲ.೯)	78.10	113.51	114.38
Sample volume (act.)	191.534	142.223	221.776
Jarometric press. (in.Hg)	26.48	25.74	25.97
Volume H2O imp. (ml)	328.30	252.00	376.00
Weight change sil, gel (g)	40.00	31.30	46.00
% co2	6.50 0	5.700	6.200
X 02	10.300	11.000	11.200
PPH CO	4.200	1.300	5.50 0
% X	33.200	82.300	32.500
Area of stack (sq.ft.)	17.10	17.10	17.10
Sample time (min.)	360.00	240.60	360.00
Static pressure (in.H2O)	-0.09	-0.10	-0.10
wozzle dia. (in.)	0.360	0.260	0.360
Heter box cal.	1.0030	1.0030	1.0030
Cp of pitot tube	0.34	0.34	0.34
Laboratory Report Data			
Front helf acetone, g.	0.0009	0.0338	0.0033
filter catch, g.	0.0016	0.0019	3.0024
Yotal particulate catch, g.	0.0025	0.0049	0.0657
Smokeless powder			
Hitrated Esters	3184.97	2237.525	5774.47
Com Report Data			
NOX PPM	55.4	48.8	47.4
Total Hydrocarbon PPM	0.1	0.3	0.1

STACK TEST 5 J00°F/24 HOURS RAW OPERATIONAL DATA

TRAIS MOITIMBHE YMRE BHROITWALL AGAVEL BRAGITANE

	Jara -			
	Bun number	15-1	75-2	₹5-3
	Location		FLICHCHAMBER	I ILET
		07-29-39		07-30-89
	Time period		1900-2400	
	Coerator	JD0	JD0	LDO
Inou	ts For Calcs.			
	Sq. of Gelta P	0.424260	0.439900	0.435390
	Beita d	0.75000	0.75000	0.73000
	Stack :n. (deg.F)	373.30		397.50
	Heter tora. (deg.F)	48.30		101.50
	Sample volume (act.)	183.074		
	Barchetric press. (in.Hg)			26.28
	Volume H20 imp. (ml)	58.00	55.00	44.00
	Meight change sil. gel (4)	34.00	33.00	23.00
	+ 002	1.50	2.20	2.00
	5 ∪2	17.40	16.50	16.70
	opes CO	136.00	261.30	206.10
	¥ A	81.00	81.30	81.30
	Area of stack (sq.ft.)	1.77	1.77	1.77
	Samole 'ime (min.)	373.00	300.00	240.00
	State: pressure (In.H20)	0.05	J.05	0.05
	Hozzie ara. (in.)	AK	NA.	AK
	Meter box cal.	0.9991	0.9991	0.9991
	Op of pixet tube	0.34	0.34	0.34
Cem	Report Gats			
	Toka! Hydrocarbon PPH	32.2	50.8	45.8

HANTHORNE ARMY AMMUNITION PLANT CANTHORNE, MEVAGA

Test Bata Rum number Location Rate Fine period Operator	:	15-1	H :	SIVES TEST TE-2 CHAMBER OUT 7-29-59 1823-0129 HS/SX		7-30-89 1221-1719 2X/XS
Inputs For Cales. Sq. rt. delta P Delta H Stack temp. (deg.F) Heter temp. (deg.F) Sample volume (act.) Barcmetric press. (in.Hg) Volume H2O imp. (ml) Weight change sil. gel (g) % CO2 % V2 PPM CO % N Area of stack (sq.ft.) Sample time (min.) Static pressure (in.H2O) Mozzle dia. (in.) Heter box cal. Cp of pitot cube		0.13005 1.7289 1.53.35 1.65.33 254.112 25.11 54.00 41.00 18.100 105.000 60.700 -0.49 0.300 1.0020 0.84		0.528697 1.77347 479.54 99.28 255.323 25.41 73.00 66.00 17.400 171.200 81.000 -0.58 0.300 1.0020		0.502856 1.2000 521.23 103.20 161.335 26.37 50.00 34.30 17.500 188.500 30.300 1.77 240.00 -0.57 0.300 1.0020 0.34
Laboratory Report Data, Total ug						10.70
HMX	<	2380.00	<	127.00		12.70
RDX	<	1840.00	<	98.00	<	9.50
Trinitrobenzene (1 3 5 TNB)	<	3920.00	<	209.00	<	20.90
Dinitrobenzene (1 3 DNB)	<	1110.00	<	59.00	<	5.90
Hitrobenzene	<	7 88.00	<	42.00	<	4.20
Tetryl	<	9380.00	<	500.00	<	50.00
2 4 6 Trinitrotoluol (TMT)		76800.00		677.00		184.00
2 4 Dinitrotoluene (2 4 DNT)	<	780.00	<	42.00	<	4.20
2 6 Dinitrotoluene (2 6 DNT)	<	750.00	<	40.00	<	4.00

THAT PLANT SHEET OF PLANT

Test Data	3:1	CTICHLATE YEST	
lun number	75-1	-2-5	75-3
Location	الكلناة	CHAMBER OUTLE	1
Date	7-29-39	79-39	7-50-49
Time perfod	3955-172 0	1324-0129	1221-1719
Coenston	3 X/743	us/sx	X.Vs
Inputs for Calcs.			
Sq. nt. Seite P	0.455345	0.5352 33	0.504381
Delta H	1.51256	1.50542	1.34229
Stack temp. (deg.f)	379.36	417.37	519.43
fetor temp. (deg.?)	114.70	107.35	116.51
Sample Volume (act.)	278.342	247.516	172.369
Barcestric press. (in.Hg)	25.41	28.41	26.37
Volume H2O (mp. (ml)	77,30	27.30	52,30
Weight change sil, gel (g)	48.30	32.30	34.00
% CM2	1.200	1.500	1.500
X 32	13,100	17.400	17.300
PPM CQ	106.000	171.200	188,500
X X	30.700	81,000	30.700
Area of stack (sq.ft.)	1.77	1.77	1.77
Sample time (min.)	370.00	360.00	240.00
Static pressure (in.H2O)	-0.50	-0.57	-0.58
Nozzle die. (in.)	0.310	0. 110	0.310
Heter box cal.	1.0020	1.0020	1.0G2 0
Cp of pitot tube	0.34	0.34	0.34
Nitrated Esters	23326.00	1041.31	4389.53
Cam Report Date			
Total Hydrocarbon PPM	25.0	34.7	30.5

HANTHORNE SRMY ROBUNITION PLANT DANTLORNE, REVADA

Test Cata		EXP	OSIVES TEST	
aun eumber		T5-1	75-2	T5-3
Location			ERBURKER OUTL	
Late		7-29-69	7-29-39	7- :0-89
Itiae period	99	755-1720	1824-0129	1221-1718
Operator		CH/HS	JA/SK	XS/KJ
Inputs For Calcs.				•
Sq. rt. delta P		0.099307	0.100790	0.096153
Delta H		0.06 603	1.00944	0.927500
Stack temp. (deg.F)		169 2.26	1703.71	1713.06
Merer temp. (deg.F)		117.94	105.44	119.55
Sample volume (act.)		239.43 5	219.521	142.885
Barometric press. (in.Hg)		26.41	26.41	26.37
Volume H2O imp. (ml)		358.0 C	301.00	180.00
Height chage sil. gel (g)		46.50	63.00	36.00
\$ CÓ2		5.300	6.200	6.100
3 02		10.200	11,000	11.200
PPH CO		6.900	5.600	6.90 0
3 N		83.100	82.300	32.700
Area of stack (sq.ft.)		17.10	17.10	17.10
Sample time (min.)		390.00	36 0.00	240.00
Static pressure (in.H20)		-0.10	-0.10	-0.10
Nozzle dia. (in.)		0.300	0.800	0.800
Heter box cal. Op of pitot tube		0.9953 0.34	0.9953 0.34	0.9953
cp of pitat tage		0.54	0.54	0.84
Laboratory Report Data, Total ug				
HHX		12.70	1.47 <	1.27
ROX		2.75	2.57	2.84
Trinitrobenzene (1 3 5 TNB)	<	2.09	2.19	7.62
Dinitrobenzene (1 3 DNB)		2.63	7.60	1.90
Witrobenzene	<	0.42	1.56	1.91
Tetryl	*	5.00 <	5.00 <	5.00
2 4 6 Trinitrotoluol (TNT)	<	1.92 <	1.92 <	1.92
. 2 4 Dinitrotoluene (2 4 DNT)	<	0.42 <	-	0.42
• •				
2 6 Dinitrotaluene (2 6 DNT)	<	0.40 <	0.40 <	0.40

ATTECRME ADMY HOUMITTON PLANT AREA CANDA

Tost Data tun mulban	41774121 15-1	D ESTERS IMD P	ARTICULATE TEST
Location		ERBURGER OUTLE	
2at•	7-29-39	7-19-39	7-30-8 9
Time period	3955-1720	1824-0129	1221-1718
Caraton	ZV/KL	-M/CK	LAVVS
Inputs for Calcs.			
.q. rt. ≾elta P	0.078273	0.107730	0.101726
Daita H	1.12949	1.39056	1.25958
Stack temp. (deg.F)	1397.56	17126	1719.26
Reter temp. (deg.f)	111.97	102.55	111.39
Sample volume (act.)	243.418	242.749	156.510
Garrametric press. (in.Hg)	25.41	25.41	26.37
Volume HZO imp. (ml)	316.30	339.00	264.80
Height chinge sil. gel (g)	53.00	59.00	32.00
\$ C)2	6.50	6.20	6.10
% 02	10.30	11.00	11.20
APM CO	6.90	5.50	6.70
% N	53.10	82.30	32.70
Area of stack (sq.ft.)	17.10	17.10	17.10
Sespie time (min.)	390.00	360.00	240.30
Static pressure (in.H2O)	-0.10	-0.10	-0.10
No.zle dim. (in.)	0.310	9.310	0.310
Meter box cal.	1.0030	1.0030	1.0030
Ca of pitot tube	0.34	9.34	0.34
Emboratory Report Data			
Front half scetone, g.	0.0029	0.0012	0.000
Filter catch, g.	0.0015	0.0005	0.0000
Total particulate catch,g.	0.0044	0.0017	0.0000
Nitrated Esters	1847.5 <	2575 <	1413
Cam Report Data			
NOX PPM	57.3	48.7	51.7
Total Hydrocarbon PPN	0.6	0.3	0.4

STACK TEST 2 400°F/24 HOURS ANALYTICAL DATA SUMMARY



ROY F. WESTON, INC. Library

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-19, 20, 8-1

PFN#: 8907L060,073,158, 137

3908L202 W.O.#: 7231-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR126 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager

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Liehville Analytical Laboratory

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GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

Method or preparation blank. Matrix Spike. Matrix Spike Duplicate. MB

MS

MSD

Sample Replicate. REP

LC Indicates a method LCS or Blank Spike.

NC Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

Metals prep test for AA digestion, water matrix. Metals prep test for AA digestion, soil matrix. Metals prep test for ICP digestion, water matrix. Metals prep test for ICP digestion, soil matrix. MAAW -MAAS -MICW -MICS -

M**TO-This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO+ This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox M**EPsilver).

I**TO-This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. MESTON INC.
INORGANICS DATA SUMMARY REPORT 02/15/90

CLIENT: USATHAMA-HYAAP
WCRK ORDER: 2231-03-04-0000
WESTON BATCH #: 3907L158

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-015	UH-FCO-PART-BHW (2-1	NITRATED ESTERS	29700	UG	1400
-015	UH-FCO-PART-BHA T2-1	NITRATED ESTERS	743	UG	338
-017	UH-AO-PART-FHA T2-1	PARTICULATE	0.0061	grams	0.0000
-018	UH-AO-PART-FILT-T2-1	PARTICULATE	0.0026	grams	0.0000
-019	UH-AO-PART-BHW-T2-1	NITRATED ESTERS	1550 u	UG	1550
-020	UH-AO-PART-BHA-T2-1	NITRATED ESTERS	250 u	UG	250
-035	UH-FCO-PART-BHW T2-2	NITRATED ESTERS	12500	UG	1250
-036	UH-FCO-PART-BHA T2-2	NITRATED ESTERS	1420	UG	425
-037	UH-AO-PART-FHA T2-2	PARTICULATE	0.0031	grams	0.0000
-038	UH-AO-PART-FILT T2-2	PARTICULATE	0.0018	grams	0.0000
-039	UH-AO-PART-EHW T1-2	NITRATED ESTERS	1480 u	UG	1480
-040	UH-40-PART-BHA T2-1	NITRATED ESTERS	175 u	UG	175
-051	COMP FLO PT T2-1	NITRATED ESTERS	. 5.0 u	UG	5.0
-052	CCMP AO PT T2-1	HITRATED ESTERS	5.0 u	UG	5.0
-053	COMP FLO PT T2-2	NITRATED ESTERS	11.1	UG	5.0
-034	COMP AO PT T2-2	NITRATED ESTERS	5.0 u	UG	5.0

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

CLIENT: USATHAMA-HMAAP WCAK ORDER: 2231-03-04-0000			MESTON BATCH #: 890				
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTIN LIMIT		
BLANK10	S9LNC008-MB1	NITRATED ESTERS	2.5 u	HG/L	2.		
BLANK20	89LNC008-MB2	NITRATED ESTERS	2.5 u	MG/L	2.		

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HMAAP MOAK ORDER: 2231-08-04-0000 WESTON BATCH #: 3907L158

HOME OND	EN. 2251 00 04 0000		SPIKED	INITIAL	SPIKED	
SAMPLE	SITE ID	ANALYTE	SAMPLE	RESULT	AMOUNT	%RECOV
*******	**************	*****************	******			
BLANK10	39LNC008-M81	NITRATED ESTERS	10.3	2.5 u	10.0	108
BLANK20	89LMC008-MB2	NITRATED ESTERS	49.5	2.5 t	50.0	99.3
		NITRATED ESTERS	49.5	251	50.0	99 3

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INCRGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP NCRK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L1!

			SPIKE#1	1 SPIKE#2	2
SAMPLE	SITE ID	ANALYTE	%RECOV	%RECOV	WIFF
-		***************		~====	*****
BLANK20	39LNC008-MB2	NITRATED ESTERS	99.3	99.0	0.20
		•			

ROY F. WESTON INC.
INCRGANICS DATA SUMMARY REPORT 02/13/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L187

	SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
	-015	UH-FCO-PART-BHW T2-3	NTRATED ESTERS	1330	UG	1150
	-017	UH-FCO-PART-BHA T2-3	NTRATED ESTERS	650 u	UG	650
,	-013	UH-AO-PART-FHA T2-3	PARTICULATE	0.0037	grams	0.0000
	-019	UH-AO-PART FLT-T2-3	PARTICULATE	0.0020	grams	0.0000
	-020	UH-AO-PART-BHW T2-3	NTRATED ESTERS	1180 u	UG	1180
•	-021	UH-AO-PART-BHA T2-3	NTRATED ESTERS	252 u	UG	25 2
	-024	CCMP FCO PART T2-3	NTRATED ESTERS	6.4	UG	5.0
	-025	CCMP AO PART T2-3	NTRATED ESTERS	5.0 u	UG	5.9

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/15/90

	JSATHAMA-HWAAP ER: 2281-08-04-0000		WESTON	3ATCH #:	8907L137
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPURTIN LIMIT
SLANK10	89LNC008-MB1	NTRATED ESTERS	2.5 u	MG/L	2.3
BLANK20	89LNC008-MB2	NTRATED ESTERS	2.5 u	MG/L	2.5

INCREANICS ACCUMACY REPORT 02/16/30

CLIENT: USATH MA-HNAAP WORK ORDER: 2281-03-04-6000 WESTON BATCH #: 89071187 **GBXISE** INITIAL SPIKED SAMPLE SITE ID SAMPLE AMCUNT "RECOV PHALYTE RESULT **建设设在新港市市市市市市市市市市市市市市市市市** ---------******* NTRATED ESTERS NTRATED ESTERS NTRATED ESTERS 2.5 u 2.5 u 2.5 u SLAMK10 39LNC008-MB1 10.3 10.0 103 49.5 49.5 BLANK20 39LNC008-M82 99.3 50.0 50.0 99.0

INCRGANICS DUPLICATE SPIKE REPORT 02/16/90

CLIENT: USATHAMA-HWAAP WORK ORDER: 2231-08-04-0000 WESTON BATCH #: 3907L18

SAMPLE	SITE ID	ANALYTE		1 SPIKE#1 %RECGV	_
****	**************	**************	*****	****	***
BLANK20	89LNC008-MB2	NTRATED ESTERS	99.3	99.0	0.20

ROY F. WESTON, INC. Lichville Laboratory

CLIENT: USATHAMA - HAWTHORNE

SAMPLES RECEIVED: 07-27-89

RFN #: 3907L153, Air 7.0.4: 2231-08-04

EKPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LWO2, Explosives in Soil, modified for the analysis of MM-5 samplas.

The following QA/QC control samples have been concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS Designates sample spiked with target compound.

SSD Designates sample spiked with target compound in duplicate.

D Indicates duplicate analysis of a sample.

NS Not spiked.

DL Diluted below calibration range.

Indicates elevated detection limit due to sample G interference.

NE Not reported.

Spikes have been reported as result (% recovery). NOTE:

Data Oualifiers

Less than

Greater than

Analysis Summary:

Samples Collected: 07-25-89 Samples Prepared: 07-28,31-89 Samples Analyzed: 08-07-89

Carter Nulton, Ph.D.

Vice President/Laboratory Manager Lionville Analytical Laboratory

NCTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Mcdifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS AIR EXPLOSIVES SATA

RFW Batch Number: 8907L158		CLIENT:	USATH	AMA-H	JEATHAMA-HAWTHORUE					Faye:
	C	T: -1	T2-1		12-2 ECO		'r2-2	ысанк	*	1
Sample Information	REW#:	047	048		040		0.50	055	ъ c	प्राप्ताव
	D.F.: Units:	2500 Total ug	1.0 Total	бn	2500 Total ug		1.0 Total ug	Total	0 1 ug	Total
WX	MAX <	3180	16.69	V	3180		6.246	4.086	9	1.27
RDX	RDX	2450	> 0.98	v	2450	٧	96.0	86.0 >	3	85.0 >
1,3,5-TMB	1,3,5-THB	5230	5.906	v	5230	٧	2.09	< 2.09	<u>ي</u> د	2.02
1,3-DNB	1,3-DNB	1480	2.78G	V	1480	•	2.426	2.18	٠ و،	69.0
HITROBENZEWE	KITROBENZEHE	1050	< 0.42	v	1050	٧	0.42	< 0.42	cı	< 0.42
retral	TETRYL	12,500	< 5.00	v	12,500	v	5.00	< 5.0	•	5.00 ×
2, 4, 6-TNT	2,4,6-TNT	70,400	< 1.92		39,500	v	1.92	< 1.9	7	25.1 >
2, 6-DN'r.	2,6-DN/f	1000	< 0.40	v	1000	٧	0.40	0.426	"	0.4.0
2.4-DWC.	2.4-DWC	1050	< 0.42	v	1050	v	0.42	< 0.4	ci Ci	c 0.42

1 1	100XSSD 1 1 Total ug	111 (87.4%) 85.6 (87.3%) 162 (77.5%) 42.6 (72.2%) 3.19 (7.57%) 349 (69.8%) 129 (67.1%) 18.5 (46.3%) 26.9 (54.0%)
i i	100XSS 1.0 Total ug	106(83.4%) 81.6(83.3%) 158(75.6%) 42.3(71.5%) 3.24(7.71%) 330(66.0%) 130(67.7%) 19.6(49.0%)
!	20XSS 1.0 Total ug	21.9(86.24) 17.3(88.34) 31.0(74.24) 7.68(65.14) < 0.42(0.04) 25.0(55.04) 26(67.74) 3.09(38.64) 5.36(63.84)
Client Th .	RFW#: D.F.: Units:	HMX. RDX. 1,3,5-TWB. 1,3-DMB. NITROBENZENE. 2,4,6-TWT. 2,4-DWT.
	Information	HMX. RDX. 1,3,5-TwB. 1,3-DuB. NITROBENZENE Z,4,6-TwT. 2,4-DwT.

G-Elevated

ROY F. WESTON, INC. Lichvilla Laboratory

CLIENT: USATHAMA - HAWTHORNE

SAMPLES RECEIVED: 07-29-39

RFN #: 3907L137.Air W.O. #: 2281-08-04

EKPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of MM-5 samples.

samples following QA/QC control analyzed have been concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

Reagent blank analyzed to provide an indication of BLX = lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

Designates sample spiked with target compound.

SSD Designates sample spiked with target compound in

duplicate.

D Indicates duplicate analysis of a sample.

NS Not spiked.

Diluted below calibration range. DL

Indicates elevated detection limit due to sample G

interference.

NR Not reported.

NOTE: Spikes have been reported as result (1 recovery).

Data Qualifiers

Less than

Greater than

Analysis Summary:

Samples Collected: 07-26-89 Samples Preparad: 07-29,31-89 Samples Analyzed: 08-07-89

Carter Nulton, Ph.D.

Vice President/Laboratory Manager

Lionville Analytical Laboratory

NCTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

VESTON ANALYTICS AIR EXPLOSIVES DATA

RFW Batch Number: 8907L187	37	CLI		USATHA	MA-H	USATHAMA-HAWTHORUE	32	: ច្រីស្ក
	Cllent	T2-3		T2-3		1 1 1		
Sample	I QI	FC0		AO				
Information	RFG#:	022		023		BLANK		20X5S
	D.F.:	2.5		1.0		-		-4
	Units:	-		Total	ng	Total	bn	Total ug
HHX	• • • • • • • • • • • • • • • • • • • •	8.266		< 1.27	V	1.27		20.8(81.5%)
RDX	• • • • • • • • •	< 2.45		2.926	v	0.98		15.8(80.6%)
1, 3, 5-TNB	• • • • • • • • •	< 5.23	٧	5.09	٧	2.09		29.1(69.6%)
1,3-DNB.	• • • • • • • • •	6.64G		3.056	٧	0.59		6.24(52.94)
NITROBEMZENE	• • • • • • • • •	< 1.05	٧	0.42	v	0.42		< 0.42(0.0%)
TETRYL.	• • • • • • • • •	< 12.5	٧	5.00	v	5.00		53.4(53.4%)
2, 4, 6-ThT	• • • • • • • • • • • • • • • • • • • •	93.6	٧	1.92	v	1.92		21.0(54.74)
2,6-DNT	• • • • • • • • • • • • • • • • • • • •	< 1.00	٧	0.40	٧	0.40		2.56(32.0%)
2,4-DMT	• • • • • • • • • • • • • • • • • • • •	< 1.05	٧	0.43	٧	0.42		4.41(52.5%)

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Sample	ID :		
Information	RFW#:	100XSS	100XSSD
	D.F.:	• 1	-
	tolts:		Total ug
HMX.		99.2(78.1%)	109 (85.8K)
RDX	• • • • • • • • • • • • • • • • • • • •	80.8(82.4%)	84.0(85.7%)
1, 3, 5-TNB	• • • • • • • • • • • • • • • • • • • •	158 (75.68)	157(75.1%)
1,3-DNB	• • • • • • • • • • • • • • • • • • • •	41.7(70.6%)	39.4(66.8%)
NITROBENZENE	• • • • • • • • • • • • • • • • • • • •	1.26(3.00%)	4.27(10.2%)
TETRYL.	• • • • • • • •	322(64.48)	330 (66.04)
2, 4, 6-TNT		126(65.6%)	124 (64.5%)
2, 6-DMT		17.7 (44.2%)	16.3(40.6%)
2,4-DMT		26.6(63.3%)	24.6(58.64)

G-Elevated

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STACK TEST 3 500°F/36 HOURS ANALYTICAL DATA SUMMARY



ROY F. MESTON, INC. Licaville Laboratory

CLIENT: USATHAMAHWAAP

EAMPLES RECEIVED: 7-19, 20, 8-1 RFW#: 3907L060,078,153, 137

3908L202

W.O.#: 2281-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Jack R. Tuschall, Ph.D.

Laboratory Manager

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Dishville Analytical Laboratory

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GLOSSARY OF TERMS - INCRGANIC REPORTS

DATA CUALIFIERS

- Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unraliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

Method or preparation blank. Matrix Spike. MB

MS

MSD Matrix Spike Duplicate.

REP Sample Replicate.

LC Indicates a method LCS or Blank Spike.

NC Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

Metals prep test for AA digestion, water matrix. MAAW -MAAS -Metals prep test for AA digestion, soil matrix. Metals prep test for ICP digestion, water matrix. MICW -MICS -Metals prep test for ICP digestion, soil matrix.

-0T**K This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO-This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP-This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

This type of code indicates a non-metallic total I**TOanalysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. MESTON INC.
INORGANICS DATA SUMMARY REPORT 02/16/90

	GLIENT: WORK ORI	USNTHAMA-HWAAP DER: 2281-08-04-0000	:	WESTON	BATCH #:	390/L060
	SAHPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
	-027	UH-PART-FCO-BHW-T3-1	NITRATED ESTERS	26200	UG	5250
	-023	UH-PART-FCO-BHA-T3-1	NITRATED ESTERS	9980	UG	1720
>	-029	UH-PART-AO-FHA-T3-L1	PARTICULATE	0.0009	grams	0.5000
	-030	UH-PART-AO-FILT-T3-1	PARTICULATE	0.0016	grams	0.0000
•	-031	UH-PART-AO-BHW-T3-1	NITRATED ESTERS	3650	UG	3500
	-032	UH-PART-AO-BHA-T3-1	NITRATED ESTERS	300 u	UG	800
	-035	UH-PART-FCO-BHW-T3-2	NITRATED ESTERS	8330	UG	1900
	-036	UH-PART-FCO-BHA-T3-2	NITRATED ESTERS	1850 u	UG	1880
	-037	UH-PART-AO-FHA-T3-2	PARTICULATE	0.0030	ams	0.0000
	-038	UH-PART-AO-FLT-T3-2	PARTICULATE	0.0019	grams	0.0000
	-039	UH-PART-AO-BHW-T3-2	NITRATED ESTERS	2570	UG	2620
	-040	UH-PART-AO-BHA-T3-2	NITRATED ESTERS	500 u	UG	500
	-045	UH-BLK-FILT-PART	PARTICULATE	0.0001	grams	0.0000
	-046	UH-BLK-ACETONE-PART	PARTICULATE	0.0000	grams	0.0000
	047	UH-BLK-PART-WATER	NITRATED ESTERS	975 u	UG UG	
	-053	COMP FCO PART T3-1	NITRATED ESTERS	12.7	UG	975
	-054	COMP AO PART T3-1	NITRATED ESTERS	12.9	UG	10.0
₹	-055	COMP FCO PART T3-2	NITRATED ESTERS	10.0 u	UG	10.0
•	-056	COMP AO PART T3-2	NITRATED ESTERS	11.4	UG	10.0
	-057	CCMP OF PART BLANK	NITRATED ESTERS	10.0 u	UG	10.0
λ				10.0 0	VG	10.0

ROY F. WEUTEN INC.
INORGANICS METHOD BLANK DATA SURMARY PAGE 02/15/90

	SATHAMA-HNAAP R: 2231-03-04-0000		WESTON	3ATCH #:	3907L060
SAMPLE	SITE ID	ANALYTE	RESULT	צדוייִט	REPORTING
BLANK10	89LNC004-MB1	MITRATED ESTERS	5.0 u		3.
BLANK20	89LNC004-MB2	NITRATED ESTERS	5.0 u	MG/L	5.
SLANK10	89LNC006-MB1	NITRATED ESTERS	5.0 u	MG/L	5.
BLANK20	89LNC006-MB2	NITRATED ESTERS	5.0 u	MG/L	5.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HYAAP WORK ORDER: 2231-08-04-0000

WESTON BATCH #: 8907L060

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	RESULT	SPIKED	MRECOV
公司法律的政治	*************	1. 日本日本 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	****	- 現代開発が発揮	共和国共和国	油量が食物を
3LANK10	391 NCO04-MB1	NITRATED ESTERS	10.9	5.0 u	10.0	109
BLA-JXCO	89LNC004-MB2	NITRATED ESTERS	47.8	5.0 u	50.0	95.5
		NITRATED ESTERS	47.9	5.0 u	50.0	95.3
3L.MK10	89LNC005-MB1	NITRATED ESTERS	9.0	5.0 u	10.0	90.0
BLANKED	39LNC006-MB2	NITRATED ESTERS	46.7	5.0 u	50.0	93.3
		NITRATED ESTERS	48.9	5.0 u	50.0	97.7

INGREANICS DUPLICATE SPIKE REPORT 02/15/90

GLIENT: USATHAMA-HMAAP MCRK ORBER: 2231-03-04-0000

WESTOM BATCH #: 8907L06

			SPIKER	1 251353	2
SAMPLE	SITE ID	ANALYTE	KRECOV	RECOV	MDIFF
2000年10日1日	名本本本本的 有表现的主义和	*************		****	*****
SLAWK20	89LNC004-M82	NITRATED ESTERS	95.5	95.9	0.30
31 MW96	RUL VICTORS_MR2	VITOATED COTEDO	03.3	97 7	4 -

FOY F. WESTON INC.
INORGANICS DATA SUMMARY REPORT 02/16/90

	ISATHAMA-HWAAP		WESTON	BATCH #:	3907L073
SAMPLE	R: 2281-08-04-0000 SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-015	UH-FCO-PART-BHW-T3-3	NITRATED ESTERS	8080	UG	3120
-016	UH-FCO-PART-BHA-T3-3	NITRATED ESTERS	1120 u	UG	1120
017	UH-AO-PART-FHA-T3-3	PARTICULATE	0.0033	grams	0.0000
-018	UH-AO-PART-FILT-T3-3	PARTICULATE	0.0024	grams	0.0000
-019	UH-AO-PART-BHW-T3-3	NITRATED ESTERS	6200	UG	3450
-020	UH-AO-PART-BHA-T3-3	NITRATED ESTERS	1200 u	UG	1200
-021	UH-PT-FCO-PRE-H20	NITRATED ESTERS	725 u	UG	725
-022	UH-PT-FCO-PRE-ACE	NITRATED ESTERS	1250 u	UĞ	1250
-023	UH-PT-AO-PRE-H2O	NITRATED ESTERS	600 u	บด	600
-024	UH-PT-AO-PRE-ACE	NITRATED ESTERS	975 u	UG	975
-031	COMP FLO PT T3-3	NITRATED ESTERS	11.5	UG	10.0
-032	COMP AO PT T3-3	NITRATED ESTERS	10.0 u	UG	10.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/15/30

	SATHAMA-HWAAP R: 2281-08-04-0000		WESTON	BATCH #:	33 07L07 8
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	89LNC004-MB1	NITRATED ESTERS	5.0 u		5.
BLANK20	39LNC004-MB2	NITRATED ESTERS	5.0 u	MG/L	5.
BLANK10	89LNC006-MB1	NITRATED ESTERS	5.0 u	HG/L	5.
BLANK20	39LNC006-MB2	NITRATED ESTERS	5.0 น	MG/L	5.

INORGANICS ACCURACY REPORT 02/16/90

CLIENT: USATHAMA-HYAAP WCRK ORDER: 2281-08-04-0000

WESTON BATCH #: 8907L078

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
SLANK10 BLANK20	89LNC004-MB1 39LNC004-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	10.9 47.3 47.9	5.0 u 5.0 u 5.0 u	10.0 50.0	109 95.5 95.9
BLANK10 BLANK20	89LNC006-MB1 89LNC006-MB2	NITRATED ESTERS NITRATED ESTERS NITRATED ESTERS	3.0 46.7 48.9	5.0 u 5.0 u 5.0 u	10.0 30.0	90.0 93.3 97.7

INCRGANICS DUPLICATE SPIKE REPORT 02/15/90

CLIENT: USATHAMA-HWAAP WORK CRDER: 2231-03-04-0000

WESTON BATCH #: 3907LOT

SAMPLE	SITE ID	ANALYTE	SPIKER	_
	89LNC004-M82	NITRATED ESTERS NITRATED ESTERS	#RECOV 35.3 97.7	#DIFF 0.30

KETEN

ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE

SAMPLES RECEIVED: 07-19-89

RFN #: 8907L060, Air W.O.#: 2281-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LWO2, Explosives in Soil, modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

SSD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL - Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

Data Qualifiers

< = Less than

> = Greater than

Analysis Summary:

Samples Collected: 07-17-89
Samples Prepared: 07-20-89
Samples Analyzed: 08-07-89

Carter Nulton, Ph.D.

22.02

Vice President/Laboratory Manager

Lionville Analytical Laboratory

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LWO2 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS AIR EXPLOSIVES DATA

RFW Batch Number: 8907L060	j j	CLIENT:	CLIENT: USATHAMA-HAWTHORNE	HAWTHC	RNE					řeye: 1	~
	Client	T3-1	T3-1	T3-2	.2	T3-2		BLANK			
Samole	: QI	FCO	AO	F.CO	ဝ္ပ	AO					
Information	RFW#:	048	049	050	0.	. 051		052		BLANK	
	D.F.:	2500	1.0	C	25	1.0		7.0	•	3.0	_
	••	Total ug	Total ug	Total	ıl ug	Total ug Total ug	ng	Total	n J	Total	ار ال
HHX		3180	< 3180 < 1.27	< 31.	8	1.27	٧	1.27	V	1.27	
BDX	>	2450	3.816	< 24.	ري ريا	3.826	v	0.98		0.98	
1.3.5-TMB.	V	5230	< 2.09	< 52.	er,	3.466	٧	2.09	•	2.09	_
1,3-DNB	>	1480	5.600	< 14.8	8	8.40G	v	0.59	•	0.59	_
NITROBENZEWE	>	1050	< 0.42	< 10.5	ທ	20.26	٧	0.42	•	0.42	
TETRYL	>	12,500	< 5.00	< 125	2	5.00	٧	5.00	•	5.00	_
2.4.6-TWT	• • • • • • • • • • • • • • • • • • • •	89,200	< 1.92	64	٧	1.92	٧	1.92	7	1.92	••
2.6-DNT	>	1000	< 0.40	< 10.0	v 0	0.40	٧	0.40	•) * · O	_
2,4-DNT	>	1050	< 0.42	< 10.	ις. V	0.45	v	0.42	•	G. 42	~1

	+40+10	1	2 2 6	1 1 1	
84 Case 8	ID :				
Information	REWAL	20XSS	100XSS	100XSSD	
	D.F.:	-	~4	-	
	Unite:	Total ug	Total ug	Total ug	
		26.7(105%)	124(97.6\$)	130(102%)	1
RDX		20.2(103%)	99.2(101%)	100(102%)	
1.3.5-TWB.		44.9(107%)	213 (102%)	210(100%)	
1,3-DMB		11.4(96.6%)	58.3(98.8%)	53.4(90.5%)	
NITROBENZEME	• • • • • • • • • • • • • • • • • • • •	< 0.42(0.0%)	16.2(38.6%)	< 0.42(6.0%)	
· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • • • • • • • • • • •	94.4(94.4%)	475 (95.0%)	472 (94.48)	
1.6-THT.	•	35.7(92.94)	185(96.3%)	187 (97.4%)	
2,6-DkT.	•	7.46(93.2%)	40(100\$)	35.7(89.31)	
	• • • • • • • • • • • • • • • • • • • •	7.96(94.8%)	40.3(96.0%)	38.3(91.1%)	

G-Elevated

KEEEN

ROY F. WESTON, INC. Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE

SMEPLES RECEIVED: 07-19-89

RFW #: 3907L073, Air W.O.#: 2231-08-04

ENFLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil, modified for the analysis of WM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Pescription

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

SSD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample interference.

NR = Not reported.

NOTE: Spikes have been reported as masult (% recovery).

Data Gualifiers

< = Less than

> = Greater than

Analysis Summary:

Samples Collected: 07-18-89 Samples Prepared: 07-21-89 Samples Analyzed: 08-07-89

Carter Nulton, Ph.D.

PS/ICK

Vice President/Laboratory Manager Lionville Analytical Laboratory NOTE: Non-quantitative recoveri were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysi... Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

WESTON ANALYTICS AIR EXPLOSIVES DATA

		Ţ	AIR EAPLOSIVES FRIA	AIR EAFLOSIVES USTR	
16	907L078	CLIENT:	USATHARA-HAWTHORIE	IAWTHORKE	, to JA's
	Client	T3-3	T3-3	# 1	
Information	KEZ	1-6 COM.	7-12 CUM.	BLANK	20XSS
	D. F.	10	1.0	1.0	1.0
	Unite	_	fotal ug	Total ug	Total ug
		< 12.7	< 1.27	< 1.27	28.4(1114)
REX			2.80G	se.0 >	23.5(120%)
1,3,5-TilB	•	21.76	2.78G	< 2.09	47.9(1154)
1,3-DliB.	•	< 5.90	5.3.76	< 0.59	10.4(38.13)
NITROBENZENE	•	22.06	< 0.42	< 0.42	0.42(0.0%)
TETRYL.	• • • • • • • • • • • • • • • • • • • •	< 50.0	< 5.00	> 00.6	111(111%)
2,4,6-TWT	• • • • • • • • • • • • • • • • • • • •	171		< 1.92	40.1(104%)
2,6-DNT	• • • • • • • • • • • • • • • • • • • •	00. *		< 0.40	6.49(81.18)
2,4-Did.	• • • • • • • • • • • • • • • • • • • •	< 4.20	0.42	< 0.42	7.75 (92.78)
	Client		:		* * * * * * * * * * * * * * * * * * * *
Sample	: OI				
Information	RECE		100XSS		100%50
ONITS:	units:		rotal ug		Total ug
HriX.	• • • • • • • • • • • • • • • • • • • •		135(106%)		·
RDX	• • • • • • • • • • • •				$\overline{}$
1, 3, 5-THB	• • • • • • • • • • • • • • • • • • • •		226(108\$)		213(1024)

G-Elevated

TETRYL. NITROBENZEYE........

RDX

55.4 (93.5%) 6.00(14.34)

61.3(104\$) 8.80(21.0\$)

528(106%) 195(102\$)

40.1(100%)

498 (99.2%) 178 (97.2%)

35.8(89.5%) 38.5(91.7%)



ROY F. WESTON, IMC. Lionville Laboratory

CLIENT: USATHAMA - HAWTHORNE

SAMPLES RECEIVED: 07-19-89

RFW #: 8907L060, GC/MS SEMIVOLATILE

₩.O.#: 2231-08-02

NARRATIVE

The set of samples consisted of three HPLC extracts prepared on 07-28-89.

The samples were analyzed by GC/MS for HSL Semivolatile target compounds on 09-06-89.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

- The reported results should be considered qualitative only. Concentrations are not reported for the Tentatively Identified Compounds (TIC's).
- 2. The samples contained a variety of unknowns and a large unresolved complex of hydrocarbons and fatty acids (C14 and greater). Sample FCO-T3-1 contained higher levels than sample AO-T3-1.

Carter Nulton, Ph.D. DATE

Vice President/Laboratory Manager Lionville Analytical Laboratory

Roy F. Meston, Inc. - Lionville Laboratory BNA ANALYTICAL DATA PACKAGE FOR USATHAMA-HWAAP

DATE RECEIVED: 07/19/39

RFW LOT # :3907L060

CLIENT ID	REW#	ХТМ	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
COMP-FCO-EXP-T3-1	048	ΑI	89LE0826	07/18/89	07/28/39	09/06/89
COMP AO-EXP-T3-1	049	ΑI	89LE0825	07/17/89	07/29/89	09/06/89
COMP BLK-EXP	052	ΑI	89LE0826	07/13/89	07/28/39	09/06/89

Erw Batch Number 1 69071.060

À

Report Dates 69/11/39 16:49 Hark Orders 2291-08-02-6000

17----CCHP BLK-KXP 1.00 total ug 052 AIR 001 20 20 2020 2 OZ 3 S 2 Cust ID: Conf-FCC-EXP COMP AO-EXP-1.00 total ug AIR 0 20 20 20 20 20 202 20 ۲. ۱-4 2 2 20 20 T3-1 9 ES. 3 3 1.00 total ug 048 AIR 50 2022 50 20 202 222 222 2 20 20 3 3 2 Witrolenzene-d5 Phenol-d5 NEW I Hatrixs D. F. 1 Unites p-Terpheny1-d14 2, 4, 6-Tribromophenol 2-rluorobiphanyl 2-Fluorophenol ** Outside of EPA CLP Or limits. bla (2-chlorolacpropyl) wther H-Mitroso-bi-n-propylasina blu(2-chlorosthoxy)methand_ Haxachlorocyclopantadiena bla(2-chiczcathyl) cther 4-chioro-3-methylphenol 1, 2, 4-Trichlorobenzone 1,2-Dichlorobenzena___ 2-Mathylnaphthalene 1, 3. Dichlorobenzana 1, 4-blehlorobenzend iexachlorobutadlene 2, 4-Dichlorophanol 2, 4-Dimsthyl' henol Hazachlorosthans 4-Chlorognilling 2-Methylphenol 2-chlocophanol banzyl alcohol (-Nothylphanol Kitrobenzene benzoic acid 2-Nitrophenol Intormation Laphorona Muchthalone Surregate ROCOVERY فالإستفظ Firmol

53071 060 C11satt 0352nkhf-inakh	dka
	CCAR BLK.
त्रमण्या-मग्रम्	COMP AU-EART
Cilyate DSE	Cust Ili Chir-#CO-EAP Coap AU-bar- Coar bin bap
Name 19 19 19 19 19 19 19 1	Cust In:
Kry Fator	

· · · · · · · · · · · · · · · · · · ·		-23-1 046		T3-1 049		052		
2, 4, 6-Trichlorophenol		20	Þ	20	ם	20	n	
2, 4, 5-reichlerophanol	1	100	3	100	ם	100	Ω	
2-Chloronaphthalene	1	20	=	20	Ω	20	ם	
2-Witrosnilina		100	>	100	ລ	100	Ω	
Dimutnylphthalate		20	ם	20	ລ	20	מ	
Acenaphthylene		20	₽	20	n	20	ם	
2, &-binitrotolucno		20	>	2:0	ם	20	ם	
3-Ricrosniline		100	2	100	ຍ	100	ם	
Acenarhthena		20	Þ	20	ם	50	ם	
2, 4-Dinitrophanol		100	9	100	D	100	ם	
4-Hitrophenol		100	3	100	ם	100	ם	
Dibonrofuran		20	Þ	20	5	20	ם	
2, 4-Dinitrotoluana		270		20	5	20	ח	
brothylphthalate	•	50	₽	140		▼	מ	
6-Inlorophanyl-phanylethur	}	20	>	20	ກ	20	5	
		20	Þ	20	ם	20	כ	
-Nitrosniline	ı	100	Þ	100	,	100	ם	
f, 6-Dinitro-2-Esthylphenol		100	>	100	ם	100	כ	
W-Mitroscdiphenylamine (1)		50	Þ	20	ם	20	ח	
-Browophanyl-phenylether		20	>	50	5	20	ם	
Kazechlorobanseaa		20	Þ	20	Þ	20	ם	
Pentachlorophenol		100	>	100	>	100	Þ	
Phenanthrone		20	>	20	:	20	כ	
		50	⊃	20	ם	20	=	
Di-n-Eutylphthalate		87		68		7	ט	
Plusenitions		20	Þ	20	>	20	כ	
		70	Ö	20	-	20	מ	
Butylbannylphthalate		50	D	S	ר	7	ם	
7,3'-Dichlorobenzidina		9	5	40	ם	Q	כ	
Banzo (u) anthracene		20	=	20	ם	50	ם	
		20	Þ	20	ņ	20	n	
bla (2-sthylhaxyl)phthalate		53		40		11	מ	
pi-n-Goryl phthalate		7	ט	•	ם	50	ם	
Eanro(b) fluoranthans		20		20	ם	20	ם	
Scano(k) fluorenthene		20	5	20	5	20	מ	
Beiso(a)pyrena		20	>	20	n	20	כ	
nisano(1,2,3-cd)pyrana		20	>	20	ם	20	ם	
Dibenzo (a, h) anthracens		20	D	20	=	20	ם	
Banzo(g,h,1)kerylens		20	5	20	2	20	ם	
rated	from Diphonylamine	a minė			of BPA CLP		limits.	

17

TIME CIPTANIA COLANIO SIPATO SI SENSIONE SENSION

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Lab Name:	Nov ?. Weston, Inc.	Work Order: 2291-08-02-3000	
Cliant:	TEATHAMA-AWAAP		

 Matrix:
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3xtraction: (SepF/Cont/Sonc) Date Analyzed: 09/05/39

GPC Cleanup: (Y/N) M pH: Dilution Factor: 1.00

Number TICs found: 22

CCHCENTRATION UNITS: (ug/L or ug/Kg) total ug

CAS NUMBER	COMPCUND NAME	RT	EST. CONC.	Q
1.	THT	16.35	NA	
2.	THT	16.53	NA	i i
3.	UNKNOWN	18.18	HA	İ
4.	FATTY ACID	18.60	AK	
5.	PHTHALATE	18.73	XA	
6.	UNKNOWK	19.00	MA	İ
7.	UNKNOWN	19.17	XA	
8.	FATTY ACID	19.58	NA	
9.	UNKNOWN	19.65	MA	İ
10.	UNKNOWN	19.72	NA	
11.	UNKNOWN	19.85	XX	
12.	ZATTY ACID	2 NAO	30%	
1 :3.	UNKNOWN	20.17	MA	
14.	UNKNOWN	20.87	NOA	
15.	UNKNOWN	21.00	XA.	
16.	UNKNOWN	21.33	MA	
17.	UNKNOWN	21.45	NA.	1
18.	ALKANE	22.03	FA	
19.	UNKNOWN	22.58	NA.	
20.	ALXANE	24.83	na	
21.	UNKNOWN	25.38	NA ·	l i
22.	UNKNOWN	25.77	NA	i i

HENTATIVELY IDENTIFIED COMPOUNDS

CCMO	30-270-73-1	

طستا	Name	Roy ₹.	Weston.	Inc.	Work Order:	2231-08 /4-0000	,	

Cliant: UCATURMA-HWAAP

Hatrix: AIR Lab Sample ID: 3907L060-049

Lavel: (low/med) LOW Date Received: 07/19/89

* Moisture: not dec. ____ dec. Date Extracted: 07/28/99

Ixtraction: (SepF/Cont/Sonc) ____ Date Analyzed: 09/06/39

GPC Cleanup: (Y/N) M pfi: ____ Dilution Factor: 1.00

CONCENTRATION UNITS:

Number TICs found: 21 (ug/L or ug/Kg) total ug

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
***********			***	
1.	UNKHOWN	6.82		
2.	UNKNOWN	7.28		
3.	C4 BENZENE	7.72		
4.	UNKNOWN	8.95		
5.	UNKNOWN	9.23		
6.	UNICIONN	10.25	MA	
7.	UNKNOWN	10.43	KY.	
9.	BENZAMIDE	11.38	XA	, ;
9.	ITHYLBENZOIC ACIÓ	11.55	3 7A	
10.	ETHYLBENSOIC ACID	11.72	ATA .	
11.	UNKROWE	17.58	XA.	
12.	FATTY ACID	18.30	HA.	
13.	UNKNOWN	19.32	30A	
14.	UNIXIONN	19.90	300	
15.	FATTY ACID ESTER	19.98		
15.	UNKNOME	21.47		
17.	UNKNOWN	22.18		
18.	UNKNOWN	22.32		
19.	UNKNORN	23.15		
20.	UNKNOWN	24.47		
1 21.	URKNOWN	25.37	MA	
1	•	23.37	****	

BOLT CLATTIC COMMICS ANALYSIS STATE THE THE PARTITIES CONFOUNDS

CCXOP	BLX-XXP	
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دد:	Toma:	3 CVV	7.	Weston.	Tra.	Work	Orders	2281-08-02-0000	1
للفاصدة	14 14 14 14			100.0	- A	~~~~	AT MATE :	9 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4	- 1

Cliant: CENTUMA-WAAP Lab Sample ID: 39071060-052 Matrix: 713 Sample wt/vol: ____ (g/mL) ___ Lab File ID: 3090603 Date Received: 07/19/39 Lavel: (low/med) LCW % Moisture: not dec. ____ dec. Date Extracted: 07/28/89 Extraction: (SepF/Cont/Sonc) ___ Date Analyzed: 09/06/39

GPC Cleanup: (Y/N) N pH: ____ Dilution Factor: 1.00

CONCENTRATION UNITS:

Number TICs found: 12

(ug/L or ug/Kg) total uq

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
j 1.	UNKNOWN	14.20	NA ·	i
2.	UHICKOWN	19.77	NA	
3.	UNIXNOWN	22.53	NA	
4.	UNKNOWN	23.40	NA	
5.	UNKNOWN	23.48	NA	
6.	UNKNOWN	23.55	NA	
7.	UNKNOWN	23.73	NA	
3.	DHENONN	23.82	HA	
9.	UNXNOWN	23.93	MA	
10.	UNKNOWN	24.45	XA	
11.	UNKNOWN	24.48	XA.	
12.	UNKNOWN	24.78	XX	
		منحوسي		li

STACK TEST 5 500°F/24 HOURS ANALYTICAL DATA SUMMARY



ROY Y. HESTON, INC. Lionville Laboratory

CLIENT: USATHAMAHWAAP

SAMPLES RECEIVED: 7-19, 20, 8-1 RTW#: 3907L060,073,158, 137

3908L202 W.O.#: 2231-08-02

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

- 1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
- 2. All preparation blanks were analyzed below the required detection limit.
- 3. All calibration verification chacks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
- 4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
- 5. The methodology used to analyzed these samples for nitrocellulose and nitroglycerine is not speific enough to resolve these compounds as seperate analytes. The data have been averaged together and reported as nitrated esters.

Cack R. Tuschall, Ph.D. Laboratory Manager

Lienvilla Analytical Laboratory

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CLOSSARY OF TERMS - INCRGANIC REPORTS

DATA CUALIFIERS

- U Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.
- Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

Method or preparation blank. Mutrix Spike. MB

MS

MSD Matrix Spike Duplicate.

REP -Sample Replicate.

Indicates a method LCS or Blank Spike.

LC NC Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

Metals prep test for AA digestion, water matrix. MAAW -Metals prep test for AA digestion, soil matrix. Metals prep test for ICP digestion, water matrix. Metals prep test for ICP digescion, soil matrix. MAAS -MICN -MICS -

M**TO-This type of code indicates a total metal analysis (eq. MAGTO indicates an analysis for total silver).

M**SO-This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP-This type of code indicates an EPTORICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO I**T0indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.
INGREANICS DATA SUMMARY REPORT 02/15/90

		WES TON	BAT 'H #:	8903L202
SITE ID	ANALYTE HITRATED ESTERS	RESULT	UNITS	R.J. ORTING LIMIT 1120
UH-FCO-PART-BHA T5-1	NITRATED ESTERS	6050	UG	950
UH-FCO-PART-FHA T5-1	PARTICULATE	0.0943	grams	. iJ.0000
UH-AO-PART-FILT T5-1	PARTICULATE	0.0015	grams	0.0000
UH-AO-PART-BHW T5-1	NITRATED ESTERS	2240	UG	1550
UH-AO-PART-BHA T5-1	NITRATED ESTERS	238 u	UG	288
UH-FCO-PART-BHW T5-2	NITRATED ESTERS	1340	UG	1180
UH-FCO-PART-BHA T5-2	NITRATED ESTERS	238 u	UG	238
UH-AO-PART-FHA T5-2	PARTICULATE	0.0025	grams	0.0000
UH-AO-PART-FILT T5-2	PARTICULATE	0.0005	grams	0.0000
UH-AO-PART-BHW T5-2	NITRATED ESTERS	1320 u	UG	1820
UH-AO-PART-BHA T5-2	NITRATED ESTERS	750 u	UG	750
UH-BLK TRAIN FHA T5-	PARTICULATE	0.0007	grams	0.0000
UH BLK TRAIN BHAT5-	PARTICULATE	0.0001	grams	0.0000
UHBLK TRAIN BHW T5-2	NITRATED ESTERS	688 u	UG -	588
UHBLK TRAIN BHA T5-2	NITRATED ESTERS	225 9	UG	225
UH-FCO-PART-BHW T5-3	NITRATED ESTERS	4660	UG	1080
UH-FCO-PART-BHA T5-3	NITRATED ESTERS	462 u	UG	462
UH-AO-PART-FHA T5-3	PARTICULATE	0.0016	grams	0.0000
UH-AO-PART-FILT T5-3	PARTICULATE	0.0000	grams	0.0000
	UH-FCO-PART-BHW T5-1 UH-FCO-PART-BHA T5-1 UH-FCO-PART-FHA T5-1 UH-AO-PART-FILT T5-1 UH-AO-PART-BHW T5-1 UH-AO-PART-BHW T5-1 UH-FCO-PART-BHW T5-2 UH-FCO-PART-BHW T5-2 UH-AO-PART-FILT T5-2 UH-AO-PART-FILT T5-2 UH-AO-PART-BHW T5-2 UH-AO-PART-BHW T5-2 UH-BLK TRAIN FHA T5-1 UH-BLK TRAIN BHAT5-1 UHBLK TRAIN BHW T5-2 UH-FCO-PART-BHW T5-2 UH-FCO-PART-BHW T5-3 UH-FCO-PART-BHW T5-3 UH-FCO-PART-FHA T5-3	SITE ID WH-FCO-PART-BHW T5-1 WH-FCO-PART-BHW T5-1 WH-FCO-PART-FHA T5-1 WH-FCO-PART-FHA T5-1 WH-AO-PART-FILT T5-1 WH-AO-PART-BHW T5-1 WH-AO-PART-BHW T5-1 WH-AO-PART-BHW T5-1 WH-FCO-PART-BHW T5-2 WH-FCO-PART-BHW T5-2 WH-FCO-PART-BHA T5-2 WH-FCO-PART-BHA T5-2 WH-AO-PART-FILT T5-2 WH-AO-PART-FILT T5-2 WH-AO-PART-FILT T5-2 WH-AO-PART-BHW T5-2 WH-AO-PART-BHW T5-2 WH-BLK TRAIN FHA T5-2 WH-BLK TRAIN BHW T5-2 WHBLK TRAIN BHW T5-2 WHBLK TRAIN BHW T5-2 WH-FCO-PART-BHW T5-3 WH-FCO-PART-BHW T5-3 WH-FCO-PART-BHW T5-3 WH-FCO-PART-BHW T5-3 WH-FCO-PART-BHW T5-3 WH-FCO-PART-BHW T5-3 WH-AO-PART-FHA T5-3 WH-AO-PART-FHA T5-3 PARTICULATE WH-AO-PART-FHA T5-3 PARTICULATE WH-AO-PART-FHA T5-3 PARTICULATE	SITE ID ANALYTE RESULT UH-FCO-PART-BHW TS-1 NITRATED ESTERS 17300 UH-FCO-PART-BHA TS-1 NITRATED ESTERS 6050 UH-FCO-PART-FHA TS-1 PARTICULATE 0.0043 UH-AO-PART-FILT TS-1 PARTICULATE 0.0015 UH-AO-PART-BHW TS-1 NITRATED ESTERS 2240 UH-AO-PART-BHW TS-1 NITRATED ESTERS 238 u UH-FCO-PART-BHW TS-2 NITRATED ESTERS 1340 u UH-FCO-PART-BHA TS-2 NITRATED ESTERS 238 u UH-AO-PART-FHA TS-2 PARTICULATE 0.0025 u UH-AO-PART-BHW TS-2 NITRATED ESTERS 1320 u UH-BLK TRAIN FHA TS-2 NITRATED ESTERS 750 u UH-BLK TRAIN BHW TS-2 NITRATED ESTERS 688 u UHBLK TRAIN BHW TS-2 NITRATED ESTERS 688 u UH-FCO-PART-BHW TS-3 NITRATED ESTERS 4660 UH-FCO-PART-BHA TS-3 NITRATED ESTERS 462 u UH-AO-PART-FHA TS-3 NITRATED ESTERS 0.0016	ER: 2231-c3-04-0000 SITE ID ANALYTE RESULT UNITS UH-FCO-PART-BHW T5-1 NITRATED ESTERS 17300 UG UH-FCO-PART-BHA T5-1 NITRATED ESTERS 6050 UG UH-AO-PART-BHW T5-1 NITRATED ESTERS 2240 UG UH-AO-PART-BHW T5-1 NITRATED ESTERS 238 U UH-FCO-PART-BHA T5-2 NITRATED ESTERS 238 U UH-AO-PART-FHA T5-2 PARTICULATE 0.0005 grams UH-AO-PART-BHW T5-2 NITRATED ESTERS 1320 U UH-BLK TRAIN BHAT5- PARTICULATE 0.0007 grams UHBLK TRAIN BHW T5-2 NITRATED ESTERS 0.0001 grams UHBLK TRAIN BHW T5-2 NITRATED ESTERS 0.0001 grams UH-FCO-PART-BHW T5-3 NITRATED E

ROY F. WESTON INC.
INCREAN(CS DATA SUMMARY REPORT 02/15/00

CLIENT: USATHAMA-HWAAP WORK ORDER: 2231-08-04-0000 JESTON BATCH #: 8908L20 REPORTI: LIMIT SAMPLE SITE ID ANALYTE RESULT UNITS -051 UH-AD-PART-BHW T5-3 NITRATED ESTERS 1220 UG 1220 -052 UH-AO-PART-BHA T5-3 NITRATED ESTERS 138 UG u 138 -065 COMP-FLO-PT-T5-1 MITRATED ESTERS 5. * 5.0 UG u -056 CCMP-AO-PT-T5-1 MITRATED ESTERS 5.0 UG u 5. -069 COMP FLO-PT-TS-2 NITRATED ESTERS 5.0 u UG 5. . - 370 CCMP A0-PT-T5-2 NITRATED ESTERS 5.0 5. UG -071 CCMP-8T-PT NITRATED ESTERS 5.0 UG 5. -074 CCMP FLO-PT-T5-3 NITRATED ESTERS 5.0 UG 5. -075 CCMP AG-PT-TS-3 NITRATED ESTERS 5.0 u UG . 5.

INCRGANICS METHOD BLANK DATA SUMMARY PAGE 02/16/90

WORK ORDI	USATHAMA-HWAAP ER: 2281-08-04-0000		HESTON	BATCH #:	8908LZ02
SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLAMK10	39LNC008-MB1	NITRATED ESTERS	2.5 4	MG/L	2.5
8LANK20	89LNC008-MB2	NITRATED ESTERS	2.5 u	MG/L	2.5

INGREANICS ACCURACY REPORT 02/15/90

CLIENT: USATHAMA-HWAAP WCRK ORDER: 2231-38-04-0000

WESTON BATCH #: 8908L20

SAMPLI	SITE ID	ANALYTE	SAMPLE	RESULT		(REC
BLANK10 BLANK20	89LNC009-HB1 89LNC008-HB2	NITPATED ESTERS HITPATED ESTERS HITRAYED ESTERS	10.3 49.6 49.5	2.5 u 2.5 u 2.5 u	10.0 50.0 50.0	100

INCREMENTES PUPLICATE SPIKE REFORT 02/15/90

CLIENT: USATHAMA-HHAAP HORK ORDER: 2281-U8-04-6000

WESTON BATCH #: 8903L202

SAMPLE	SITE ID	ANALYTE	SPIKE# MRECOV	2 VDIFF	
BLARK20		NITRATED ESTERS	99.3	39.0	ù.∠ů

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ROY F. WESTON, INC. Librailla Laboratory

CLIENT: USATHAMA - HAWTHORNE SAMPLES RECEIVED: 03-01-39

RFW #: 8907L202, Air W.O.#: 2231-08-04

EXPLOSIVE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method LW02, Explosives in Soil , modified for the analysis of MM-5 samples.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation

Description

BLK = Reagent blank analyzed to provide an indication of lab contamination and its' effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

SS = Designates sample spiked with target compound.

SSD = Designates sample spiked with target compound in duplicate.

D = Indicates duplicate analysis of a sample.

NS = Not spiked.

DL = Diluted below calibration range.

G = Indicates elevated detection limit due to sample

interference.

NR = Not reported.

NOTE: Spikes have been reported as result (% recovery).

NOTE: Results for T5-1 FCO represent a minimum value as the front half XAD sample was broken during sample preparation. Observations indicate that the majority of explosives have been contained in the front half solvent rinse for Hawthorne MM-5 explosives in air samples.

Data Qualifiers

< = Less than

> = Greater than

NOTE: Non-quantitative recoveries were obtained for nitrobenzene during these analysis. Modifications made to Method LW02 to analyze MM-5 samples resulted in the loss of nitrobenzene during analysis. Although certified detection limits have been reported, it is likely that actual detection limits are higher than the detection limits reported.

Analysis Summary:

Samples Collected: 07-29,30-89
Samples Prepared: 08-02-89
Samples Analyzed: 08-10-89

Carter Nulton, Ph.D. Vica President/Laboratory Manager Lionville Analytical Laboratory

WESTON ANALYTICS AIR EXFLOSIVES DATA

RFW Batch Number: 8907L202		CLIENT:	USATHAMA	USATHAMA-HAWTHORNE		***************************************	Fuget 3
	Client	T5-1	T5-1	T5-2	T5-2	4.5±3	T5-3
Sample	I QI	FCO	FCO	FCO	Ao	FCO	O¥
Information	RFW#:	29	68	72	73	76	7.7
	0	1875	-	100	~	<u>1</u> 0	i
	Units:	Total ug	Total ug	Total ug	Total ug	Total ug	Total us
		< 2380	12.76	< 127	1.476	< 12.7	< 1.27
X		< 1840	2.766	0.86 >	2.576	08.6 >	2.846
		< 3920	< 2.09	> 209	2.196	< 20.9	7.62G
1 3-DNB		< 1110	2.63G	< 59.0	7.60G	< 5.50	1.500
MITHADBENZENE	• • • • • • • • • • • • • • • • • • • •	< 788	< 0.42	< 42.0	1.566	< 4.20	1.916
TYST T		< 9380	< 5.03	> 200	< 5.00	< 50.0	< 5.00
2.4.6-TNT		76,800	< 1.92	677	< 1.92	184	< 1.52
2 6-DVT	•	< 750	< 0.40	< 40	< 0.46	< 4.60	04.0 >
2. 4-DWP.	• • • • • • • • • • • • • • • • • • • •	> 780	< 0.42	< 42 ·	< 0.42	< 4.20	< 0.42

Client	Client	1	1	1 1	and the state of t
Sample	: QI				
ation	RFW#:	BLANK	ZOXSS	100XSS	100XSZD
	D. F. :	~	~	-4	
nn	Units:	Total ug	g Total ug	Total ug	Total Lg
		1.27	24.2(95.3%)	126(99.2%)	126(59.24)
XOX	V	85.0	20.2(103%)	106(103%)	108(110%)
1.3.5-13.80		2.09	43.6(104%)	230(110%)	233 (111%)
1.3-Dilb.	•	0.59	8,32(70.5%)	57.9(98.18)	54.4 (92.24
KITHOBENZENE.	·	0.42	< 0.42(0.0%)	< 0.42(0.0%)	< 0.42(0.0%)
TETAL	•	5.00	102(102%)	565(1134)	502(1164)
2. 4.6-TNT.	•	1.92	39.4(103%)	215(112%)	213(111%)
2,6-DMT.		0.40	4.78(59.8%)	37.6(94.04)	33.2(63.0*
2,4-DWf	*	0.45	6.40(76.1%)	43.5(104%)	42.2 (100%)

G=Elevated

ANDEADIN H

ANALYTICAL DATA SULMARY TABLES FOR TEST ITEMS

COMPUTER GENERATED ANALYTICAL DATA SUMMARY TABLES

Appendix II contains computer-generated analytical data summary tables. The tables have been prepared for pre-test and post-test sampling events.

The tables provide the following information:

- Equipment (test item) type.
- Sample matrix (wipe, rinsate or solid).
- Units.
- Contaminant mass or concentration.
- Total explosives concentration (sum of individual explosives contaminants (excludes nitrocellulose and nitroglycerin)).

A key of the sample identification conventions is provided in Table H-1.

Sample results exceeding the method detection limit (or estimated as J values) are shown in bold print.

If the analysis indicated that the compound was present below the method detection limit, the detection limit is shown with the classification U (e.g., 635U signifies that the contaminant was not present above the detection level of 635 ug).

Detection limits vary by matrix and dilution factor. In some cases, if the TNT concentration in a particular sample was high, a dilution was required to bring the concentration within the calibration range. The detection limits for the remainder of explosives analytes (e.g., tetryl) were increased proportionately.

In some cases, the mass of some contaminants is shown as a "J" value (i.e., 3.35J). This indicates that the compound was determined to be present but below the detection level. The value is estimated.

The presence of nitrobenzene in many of the wipe samples is attributable to field/laboratory contamination as discussed in Section 8 of the main report. Table 8-9 summarizes all of the nitrobenzene results.

The concentrations of some contaminants, specifically TNT in the sediment from the clay pipe, are reported as over one million parts per million (e.g., for pre-Test 15 samples, the concentration of TNT is reported as 1,246,000 ug/g). This anomaly is due to the reporting procedure. Concentrations are reported

Table H-1

Sample Identification Conventious

U - Below Detection Limit

J - Estimated Concentration

uq - Microgram

CP - Clay Play

PB - Powder Box

(M - Chip Mine

SSR - Chell Support Rack

SP - Steel Pipe
AP - Asuminum Pipe

CEMSS WALL - Flash Chamber Wall

SHR - Staem-Heated Riser

GHT - Steam-Heated Valve

FLD DINK - Field Blank

Rinsate Sample

W - Wipe Sampla

SOK - Spike Applicator

S - Spike Rinsate

as weight of TNT to weight of soil. Apparently, in this case, if the weight of TNT exceeded the weight of soil, the concentration is over 100 percent, as shown for the following hypothetical case:

- Initial TNT mass 100 grams
- Initial soil mass 50 grams
- Concentration (ppm) = mass TNT/mass soil x 100% = 100 grams/50 grams x 100% = 200%

TEST RUN 2 400°7/24 HOURS

HWAAP - Hot Gas Pilot Study Pro Yest 2 - 450 Day F, 24 Hrs

· · · · · · · · · · · · · · · · · · ·					!	,			!	1	;	
					10.	<u>.</u>			2,4,4		بر 1	16.24
TESTITEM	MATHEK	USTE	HAX	FDX	Tivas	.:: :::	2.2	TENSM	THE	D)C	Cist	Burt bereit
MOTOR BOAK	RUSE	Total	ال للارسة	S2123	115530 0	31500 U	227GD U	20000 U	10,000	21600 U	12,000	فيندوغ
Pa t	HE LOE	Totalus	U 5.28	n ces	N 6201	D 282	210 U	2530 U	ဂ ၀ ₂ ၀	200 U	210 U	ı
P8 2	BOTH ME	Task	0.530	7007	10:01	205 U	210 U	2500 U	U 034	200 U	210 U	0
63A 1	WIPE	Sea us	127 U	080	0.00	S.80 U	6.43	03 OS	470	1007	4.23.0	476
SSR 1 SPK	BUNG	Total	13300 U	10350 U	220ca U	00029	4410 U	£2500 U	131660	4200 U	74100	13,000
BSH 1 DECON	WPE	Total up	127 U	0.03.0	0 0 02	5.80 U	2.0	SQ O U	19.2 U	7 00 7	4 20 U	0.7.0
85R2	W	Total up	12.7 U	9.30 U	11862	5.90 U	4.10	\$0.0 U	1920	4.00 U	4 20 3	4.10
SSR 2 SPK	RISE	Total ug	3£30 U	2740 U	06.48 U 06.48	1850 U	1130 U	14000 U	14103	1135 U	1185 U	141600
88H 2 DECON	WPE	Total up	1210	9.80 U	30.9 U	S.90 U	6.4.0	D 0.03	1820	D 00.4	∩ 02 †	6.53

					-9'6'8				24.4	2,6	2,4	ral r.A.) E.L.	5.5
Traffital	Likind	611.0	First.	Factor	Tirel	£	E.A	YETHYI.	Yeir	ET	List	4.000.00	
GR.J. V. A.L.	Vive	Touch	1270	חניים	2090	10.8	16.0	00G	10.2.0	4.00 U	U (5)	14.6	10.0
CLAY Pure	SOAL	D/CH1	1.27 U	0 (ښکار)	2001	0 6.3 U	11 021 0	5 00 U	1 52 U	0.450 U	O 523 O	P.(A (:)	0
FEID WAIK	PILISE	Total U.	1210	9 31 11	20.00	5610	3.59.0	47.5 15	1820	3.60 U	nese	(I) Y/Y	a
FB 1 R1	P81397	162 E.D.	635 U	400 U	10:01	2.60	21012	2500 U	U CSS	U OGS	210 U	(I) V/N	Э
PB 1 H2	RUTSE	Tailed	635 U	450 U	16:00 U	25.5 U	U 012	2500 U	J (33	200 0	210 U	(i) Y/1	0
PB 1 R3	P. ISE	Telm up	U SES	460 (1	1050 U	236 U	2100	25000	0.0%	200 U	210 U	PUA (F	0
PB 1 A4		Total up	C35 U	450 U	10501)	2:5 U	210 U	25CO U	D 073	350 U	2100	E Y/N	2
SHAPALIEW	¥¥.€	Total ug	127 U	U.80 U	20.9 U	5 KO U	12.0	5000	10.2 U	4 to U		N/A (1)	12.3
SHILLHE	:WE	Tass up	1270	9.60 U	೧೯೮	n 0° 9	8.31	50.0 J	1920	∩ 00 ÷	4.600	NA (II)	15.0
St-R I RI	FIFTSE	Total up	181 U	147 U	315 U	nsea	U 0.63	75.0 U	208 U	0.00	63.0 U	N/A (1)	O
St.51 F2	FELLE	[Cr: 75]	191 U	147.U	315 U	D 5 09	೧೦ಣ	750 U	2.a U	0000	0.059	RA (1)	0
्राष्ट्र स्	1001	Col of to	U 191	147.0	F C+2 7	7.19	U 0 C4	7500	2ug U	1,100	0.000	N/A (3)	0
S.IR 1 FM	PIRISE	Total (19)	191 C	14/ U	O.tios J	6350	ეი? ეი?	750 U	2'.8 1)	60.0 U	OC ES	NA (3)	0
SINTE		Tolates	635 U	150 U	1050 U	26.5 U	210 U	2500 U	1300	2C0 U	213 U	1VA (1)	553
5; √ 1 R2	PE 13E	Tailing	625 U	453 U	1050 U	છે. ઉ	210 U	2500 U	27/13	200 U	210 U	N/A (1)	£1.5
S:N1 KB		Tailed	6550	ال ال	10.50 U	2861	210 U	2500 U	3.00	200 U	2100	(1) 5/81	3
St.V.IRA		Total US	635 U	U Gilt	1050 U	U 6.5	210 U	25.co U	2200	2CO U	210 U	144 (*)	3.13
SSA 1 WIEOT		Tuin	127 U	9.60 ()	20.9 U	១៧ន	8.83	5001	16.2 U	1.00 U	4 20 U	N. A (1)	9.3
SA 1 WITOP	WPE	ומיד שנו	127.0	U ('9' 3	20.9 U	3730	13.3	3000	19.2 U	1004	4 20 U	IV VAI	1:3
SSR 1 (V. JOT		रिवह्न प्रत	127 U	D [] 0	20.0 (1	9500	20.5	1100%	19.2 U	4000	1 cc +	E 478	103
SALIWZTOP	19 de 2	(दान्य	12.7 U	3.69 U	િ 30 8	280	6.40	SO 0.0	1320	U 00 4	4570	(1) 4/71	0.0
JCBSW1 RSS		Texas up	127.0	9 80 6	3080	35.0	17.3	50 0 U	19 2 U	4 00 5	4 20 U	N.A.D.	17.0
SSH 1 WOTOP	WE	Total C.	127 U	32.3	50.5 11	550	17.8	ာ ၁	19.2 U	4 00 11	4 20 U	(I) V/:	17.0
S50.13.150T	WiPE	Total Co	1270	n 33	50 S	25.0	16.0	50.CU	19.2 U	∩ 00 >	1 50 U	(E) V:1	10.0
SSR 1 WATOP	Sq.≯	Totalog	127 U	9 BO U	30 gC	3 G) C	15.1	50.0 U	18.2 U	700	n ~2 ★	(I) V/H	161
S	WFE	जिल्ला एक	127.0	9.50 (:	1897	280	3.1	20.0	19 2 U	1 00 t	11 02 1	PVA (3)	24.3
WWEB TANK	_!	ON RO	12.7 U	9.50 U	11603	3.5	5.22	၁၈၀၄	1920	U 00 +	4 20 U	N/A (E)	6.22
CHILL WALL WZ	₩.i.Æ	Totaling	NA (Z)	1UA (2)	LIN FOL	E.A.(2)	1CA (2)	HIA C	H/A (2)	(c) Y/M	E) VN	၁၀၁၄	1./A (c)
Str. 3 su. 4E V/2	W.55	Tailug	i4/A (2)	NA (2)	PUA IS	: N		N/A (2)	N/A (2)	N/A (2)	্য ১৯	1 S CO U	(3 K)

HWAAP - Hut Gua Pilot Shudy Pust Yest 2 - 400 Dag F, 24 Hrs TEST RUN 3 500°T/36 HOURS

1311R2

1

HWAAP - Het Gus Filot Study Fes Tust 3 - Sud Dig F, Saitte

																	_			
,	וכוער	***************************************	3	16200	0	0	0	3. 4	150	2.33	0.2.4	3	3		14.23	3.7	0	0	47.0	اق. سان
	7	Chillro	11/4 (1)	10 V/A	R'A (II)	10.40	N/A ii	10 AVA	14A (1)	11/4/11	E	11) VA	117.77	11.7	11.4(1)	10.4.01	11/A (1)	R/A (1)	(1) Y74	(I) V /II
,	į.	E E	4 23 C	45:0 U	210 U	210 U	4 20 U	420 C	ស០០០	6300	41600	2100 U	6100	فضده	384.50	32	210 U	4.20 U	420 U	6300 U
	7.6	2350	J 80.4	D 000+	200 5	ე 002	4.50 C	4 00 U	60.e U	กอเช	200 C	2000 U	200 U	2000	5000	2000	200 U	4.00 U	1000	ນ ດວວລ
	2,4,6	Titl	1920	163000	U 05-2	D 096	192U	1920	268 U	268 U	C60 U	വയാ	D 026	1003	7 00%	D OP6	D 09-5	192.0	192U	المناردا
		TETRAL !	20.33	Surks U	2500 U	2500 U	S3.0 U	50 0 U	750 U	750 U	2.00 U	25000 U	25,00 U	2000 U	22,000 U	2500 U	0005	2000	necs	150.00 U
		K.R	18.1	4200 U	210 U	210 U	4.20 U	35.7	0.0.C9	00.03	2100	2100 U	210 U	210 U	2100 U	210 U	210 U	4200	100.4	U 0000
	ų,	7	530 U	U Ovid	೧೫೪	U 205	N 03.5	D 00.2	8a S U	U 2 25	0 532	U 0265	205 U	D 508	2050 U	255 U	285 U	0 08 S	១១១ទ	U 02538
	4 4	16.3	2090	\$0300 U	U O SI	1050 U	20.9 U	2000	315 U	315 U	1050 U	10500	1050 U	1050 U	105001	1050 U	1050 U	U 6.02	20.9 U	31500 U
		FLUX	n ~o	D CCT3	→ 450 U	1 034 1 034	n 38 6	D 09.6	337	236	J 004	000.4	1900	₩ 180 C	4000 U	450 C	U 034	D 09:0	25.0	U 007+;
	-,-	N. J.	1270	12700 U	USS	635 U	127 U	127.0	15050	190.5 U	1430	0.0550	0 SEB	USES	0 0000	U SCS	U SEB	127 U	21.4	000101
		O'TLB	TOMES	c,ca	Totalio	Tally	Total U.S.	Totaluc	Totalug	Total up	Total up	Totalun	Totalua	Total LO	Takio	Totalun	Totalog	3	Taking	Totalus
		LIATELX	3611	SOL	RINGE	35135	WPE	WIFE	PANSE	E SSE	FRASE	HILLSE.	37.17.7	HUISE	SCAN.	300 SE	P. CSE	W.F.	× Fe	RUSE
		Testiven	Cit. JUVALL	CI AY P.P.E	P8 1 R1	PB2RI	PB PRE WIFE	SHAP LINE WI	SHAIR	SIMZRI	SINTRI	SITTE	8.W1 F.2	SINZRI	SIVZRI	SIVER	SIN 2R3	SM FG W.E3	SSH I DECON	S.418FK

(2) - Explosives Compounds not Analyzad.

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HWAAP - Hot Gas Pilot Study Pre Test 3 - 500 Day F, 34 Hrs

										_				_				خنبي		
7 (OL	Barran Adams	الله الله	13.0	4.5	72.3	2.03	4.3	308	643	316	152	133000	623	878	762	658	464	413	3	٥
AUT. CATELO	4.616.10	11) 4/11	(I) AVI	N/A (1)	NA (1)	N/A (II)	10,4(1)	N/A (1)	(I) Y/(I)	(i) K/N	II) Y/N	104 (1)	WA (II)	(I) Y/N	(I) V/(I)	N/A (1)	11.7A (1)	(I) KA	10.0 U	10.0 U
4.	CHT	4 20 U	42.0 U	4 20 U	42.0 U	4 20 U	450 U	4 20 U	420 U	4.25.0	420 U	ಬ ದಾಸ್ತ	4 20 U	420 U	4 20 U	4.20 11	4 20 U	4 20 U	N/A (2)	FUA (2)
ų	25.2	_ ng.+	46.5 U	1000 t	Jonak	4001	40.0 U	28.5	46.9 U	100 v	10 O	52CO U	1001	40.6 U	4:00 U	4.00 U	7:00 C	1000	N/A (2)	1UA (2)
2,4,4	IME	162U	U 52	16.2 U	182 U	23.4	162 U	19.2 U	122.0	49.1	19.2 U	133500	1920	152.0	192U	19.2 U	192U	19.2 U	N/A (2)	NA (2)
	TETHYN.	0000	0 003	C0.0 U	D 005	50.0 ()	50.0	50.0 U	500 U	50.0 U	50.0 U	0.000 U	20.0 U	500 U	50.0 U	500U	5000	50.0 U	11/A (2)	N/A (3)
	82	6.5	00.5	6.10	450 U	4.23 U	420 U	02 ¥	42.0 U	0624	0.02.≯	N 02+5	7.20	450 U	4.20 U	4.20 U	130 €	1.20 U	MA (?)	N/A (3)
¥	3	0.03.9	กงฮร	2500	noes	2000	59.0 U	5.50 U	50.0 U	D 26.3	S.S0 U	7670 U	5.60 ()	59.0 U	S.E.3 U	5.90 U	SS C	11 05:3	1(A) (2)	E VA
1,3,6		2:00	J 632	20.9 U	2000	20 g U	200 U	2090	ನ್ನು ೮	CABU	70.9 U	27300 U	20.9 U	203 U	20.9 U	20.0 U	2090	20.0 U	WA (2)	MA E
	YOU	000	75.3	030	720	D 08.6	483	311	645	D 03.9	78.2	12700 U	9.50 Ü	9/3	467	418	327	294	WA (3)	N/A (3)
	New	127 U	ביו	450	127 U	26.0	127 U	181	0 123	283	25.6	16500 U	613	121 U	368	221	157	149	(2) V	MA (2)
	21.5	Total	So repl	Total U.S.	Total ug	Total U.)	Total :: 2	To Ho	ומנש נים	Total un	Tala	Total	Total up	Commo)	Cot at to J	Totalug	Total	Totalna	3	3
	METRIX	3/4/2		WFE		WPE	APE.	,			× ×	35.2E	WPE	₹	250	THE	WFE	WPE	ME	MPc
	TESTINES	SEH 1WI	SCH 1 W1	SSA 1 W2	SSRIWZ	SSR 1 W3	SCH 1 W3	SSR 1 W4	SSR 1 WS	SBH 1 WS	SSRZDECON	SSR 2 8FK	SSR2WI	SSR2WI	SSR 2 W2	San 2 W3	SSR 2 W4	55A 2 W5	Star NO.E W2	CHI.8 W.

(1) - Fürocellukse end Narogycenhe nut Analyzed.

(2) - Explosives Compounds not Analyzed.

Hala, a specimental Study Pool Tours of the

^					1,3,6	ن ا			4 6 %	2, 29	74	/m1///12.0	YOUN
Y.41 (176.2)	MATGE	SIMO	F.S.X	FOX	200	7		TETHYL	1,,,(7	1,77	C. 12.0.3	Part courses
14. 18. 10	SON.	0/£a	1.27 U	U 0.2.0	2.00.0	0 5 m	04.30	ลเอร	1.6.11	מיזים ח	G 420 U	11.V (1)	0
·619:	FL JÜE	Total un	१८३५ ।	453 U	7000	0.593	210 U	0 008Z	0.003	n oca	210 U	(I) Y/(I)	0
71: 1FZ	FLUSE	Total Usi	บ ระว	n 034	10:01	255 U	210 U	2-00 U	D (5.3	n 738	210 U	13) Y/H	0
F4 1 R3	FullSE	Total uc	ย35 บ	460 U	11 77 22	255 (1	210 U	2500 U	0.00	U 002	210 U	(I) Y/N	0
FB: 84	RUISE	Tailug	C35 U	133	2.3	7	210 U	7500 U		200 U	2:00	(i) Y/N	0
PD W1	WIPE	Tasking	127 U	0.000	7	11.55	20.8	5000	٠,	J. 6.5.	122	(E) Y/2	20.7
STEP KILLE WI	WPE	Total up	127 U	9600	0	D (23 c	14.3	: 005	1820	700.4	42 U	(E) Y/A	22.5
S:# 1 A1	PAISE	Telding	U 191	100	1, 1,	O	0.00	1	200 U	0.000	6300	E YA	0
SHR 1 R1 DUP	FUISE	Total up	U LGI	1.70	3	3	:073		20.0	U 0 03	6300	NA (S)	0
SHIRI 1 RZ	RUSE	Total	191 (1	147 U	3	50 to 50 to	2	n	2.4.3	∩ o o o o	n o co	(I) Y/N	0
SER PROCE	R. ISE	Z F 5	101	147.5	7.7.	3	-	7	0 سة	០០១	007	(:) Y/N	0
SEE 1 PO	200	Total tro	121.0	147.62	315 (1	94 S C		15:00	253 U	000 O	0000	(I) Y/N	0
SE. 1800	RITSE	Tuind too	20.65	147 U	315 U	25.5	300	300	26.43	00.00	0.00	(I) Y/N	ဂ
SE 15:	FUTSE	Tacking	191 U	14:11	315 U	2000	21	a C. /	743	೧೦ಡ	0000	N/A (1)	621
Christ R4 N.P	RUSE	Trad up	U 161	1:7 U	315 (1	AC 2		יייי מ	2,00	១៤១	0000	NA (E)	4
Silly 1 RS		TO ME	U 131	147 U	313.0	200	ار: ا	0.037	203 U	೧೦೦೦	00.00	(;) Y' Z	9
SHIRS	::] [2]	ित्य एव	J 161	147 U	315		70	750 U	263 U	0000	0003	(I) Y/N	0

(1) - Natural Eurors not Arabyzad.

1. 1. E. S. C. Lindon Consumerate not Analyzed.

HWAAP - Not Gus Pilot Stady Post Test 3 - 600 Deg F, 36 Hrs

TOTAL DOTAL	E die s Contribute	0 (1)	0	0 (i) v	NA (1) 0	A (1) I 0	N/A (1) 0	٨ (١)	A (1) 0	A (1) 0	A (1) 0	A (1) 10.7		A (1) 8.53	A (1) 6.53	IVA (1) 12.0	NA (1) 14.7	N/A (1) 13.9	A (1) 6.23	5011 114 (3)
Mark Can	1.4.4				-	-	-		_					N/A					N'A N'A	A1/A (2) 5.1
4	CS		\dashv	Н	U 630 U	-	00:33	2100	-	210 U	U 210 U	U 4.20 U	U 4.20 U	U 4.20 U	10 4 20 U	U 420 U	1200	U 4 20 U	10 4 20 U	5
	C.637	ບ ຄາວບ			U 60.0 U	4		n seo n									U 4.00 U	U 4.G0	U 4.00 U	N/M
2.4,6	TMT) 20g U) 268 U				U 080 U		n coord	J 18.2 U	J 19.2 U		J 1 192U	1920	J 19.2 U	1 1920	19.2 U	S A111
-	TENNA	750 U	U 627	U 027	750 U	750 U	750 U		2500 U			50.0 U	30.0 U	£0.0 U	S0.0 U	50.01	20.6 U	50.0 U	50.0 U	A/A (2)
	7	0.00	00.60	1 63.0 U	1 63.0 U	1 63.0 U			2101	J 210 U	-	1 10.7		3 8 60		1 12.0	1 14.7	13.9	1 6.23	CL AVA CO
	Li.	36.78	_		C. 6.5			1 255 U	U 255		∩ 582	J 09.5	5.50 U	D 0/3/5	1 5.80 U	5.60 U	1 5.20 U	5.80 U	3.00 0	NICE CO
1	£36.7	515	318	316 U	515 (1	318	315 1	1050	10201	1050 U	1050 U	2080	200	20.00	23.9 U	_	ne ce	2000	0803	
-	First	13.63	1470	147 (5	147.0	37.1	147 U	0 057	000	7 004	7 064	9.50 U) 086	0.000	0.03.0	7 8 6	0.38.5	9.83 (0.03.8	20 415
	* FEET X	Ē	25.5	250	O 131	J 161	191 0	U 3E8	635 10	D SEB	2 828	12.70	1270	127 U	12.7 U	1270	12.7 U	12.7 U	123 U	20 212
	X United	Tetaters	Telebo	Tout	<u> </u>	TOWN CO.		-	Tading	 	Yanu	70.00	Tolding	TGHIND	Total	Tallen	Total un	۳	۲	1.000
	A LESTHUX	1	15° 2	FK 13E	35.22	FAVSE	25.55	FASE	355	PANOS	25 SE	Neg.	May W	WAFE	ANT	Wire	NATA.	A.A.S.E	355	13 SVA
	TEST MEST	SIGZRI	1.H 2 F.2	Si IN 2 N3	S. 412 FL	1.82.RS	31 to 116	18 - A2	34 N 1 R2	SI-N 1 R3	S-7.18	SCH 1 WI	SSH 1 W2	SH 1 W3	SSR I WA	SSR 1 WS	SSR 1 W8	SSR 1 W7	SSRIWe	CONTRACTOR OF THE

(1) - Ninzect Estars not Analyzad.

(2) - Explosives Compounds not Analyzed.

TEST RUN 5 500°F/24 HOUBS

HWAAP - Hot Gaz Filut Study Pre Yest 6 - 600 Dag F, 24 Hm

1,3- NB TETHYL ZAG- 2,5- Animal Total 5500 U 4500 U 4500 U 4500 U AA (1) Auron AA (1) Auron 533 U 476 U 476 U AA (1) AA (1) Auron AA (1) Auron 233 U 250 U 250 U 250 U 200 U 210 U AA (1) Auron 236 U 250 U 550 U 192 U 400 U 420 U AA (1) Auron 520 U 520 U 550 U 192 U 400 U 420 U Auron 520 U 420 U 500 U 192 U 400 U 420 U Auron 520 U 420 U 500 U 192 U 400 U 420 U Auron 550 U 420 U 500 U 192 U 400 U 420 U Auron 550 U 420 U 420 U 420 U 420 U Auron 420 U Auron 550 U 420 U 420 U 420 U 420 U <th></th>	
No.	13.8.1 G.13.7
42.00 U 500.00 U 635.00 U 45.30 U 47.6 U MA (1) 210 U 25.00 U 25.00 U 210 U MA (1) 210 U 25.00 U 192 U 200 U 210 U MA (1) 42.00 U 50.00 U 192 U 40.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 40.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U 4.00 U 42.00 U MA (1) 42.00 U 50.00 U 192 U	
10 10 10 10 10 10 10 10	200
210 U 2500 U 550 U 200 U 210 U NA (1) 210 U 2500 U 192 U 400 U 420 U NA (1) 420 U 500 U 192 U 400 U 420 U NA (1) 420 U 500 U 192 U 400 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 4.20 U NA (1) 420 U 500 U 192 U 4.00 U 4.20 U NA (1) 1 NA (2) 102 U 4.00 U 4.20 U NA (1) 1 NA (2) 102 U 4.20 U 4.20 U A.20 U	7
210 U 25.00 U 680 U 200 U 210 U MA (I) 420 U 500 U 19.2 U 4.00 U 4.20 U NA (I) 42.00 U 550 U 550 U 19.2 U 4.00 U 13.3 NA (I) 20.00 U 550 U 4.50 U 25.0 U 25.0 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 4.20 U 50.0 U 19.2 U 4.00 U 4.20 U NA (I) 1.20 U 1.2 U 4.00 U <	0000
4200 5000 1920 4000 4200 NA (1) 4200 5500 1920 4000 133 NA (1) 2550 5500 4500 2550 NA (1) 4200 5000 1920 450 420 NA (1) 4200 5500 1920 450 420 NA (1) 4200 5500 1920 450 NA (1) NA (1) 4200 5500 1920 450 420 NA (1) 4200 5000 1920 450 420 NA (1) 420 5000 1920 450 420 NA (1) 420 500 1920 450 420 NA (1) 420 500 1920 450 420 NA (1) 102 420 420 420 420 420 102 420 420 420 420 420 102 420 420 420 420 <td>30</td>	30
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2636 U 31900 U 40300 C 2550 U 2550 U NA (1) 420 U 500 U 192 U 450 U 420 U NA (1) 420 U 500 U 192 U 450 U 470 U NA (1) 420 U 500 U 192 U 450 U 420 U NA (1) 420 U 500 U 192 U 450 U 420 U NA (1) 420 U 500 U 192 U 4.00 U 4.20 U NA (1) 420 U 500 U 192 U 4.00 U 4.20 U NA (1) 420 U 500 U 192 U 4.00 U 4.20 U NA (1) 420 U 500 U 192 U 4.00 U 4.20 U NA (1) 1 NA (2) NA (2) 100 U 4.20 U NA (1) 1 NA (2) 100 U 4.20 U 1.20 U 1.20 U 1 NA (2) 100 U 4.20 U 1.20 U 1.20 U 1 NA (2) 100 U 4.20 U 1.20 U 1.20 U	4
420	
420 U 550 U 192 U 450 U 678 N/A (1) 420 U 550 U 192 U 465 U 420 U N/P (1) 420 U 550 U 192 U 450 U 420 U N/A (1) 420 U 550 U 192 U 450 U 450 U N/A (1) 420 U 550 U 192 U 450 U 450 U N/A (1) 420 U 550 U 192 U 450 U 470 U N/A (1) 1 N/A (2) N/	Ц
420 U 500 U 192 U 46.5 U 42.0 U N/4 (1) 4.20 U 5.000 U 34.620 4000 U 42.0 U N/4 (1) 4.20 U 5.000 U (19.2 U 4.00 U 4.20 U N/4 (1) 4.20 U 4.20 U N/4 (1) 4.20 U 4.20 U N/4 (1) 4.20 U 4.20 U N/4 (1) 4.20 U 4.20 U N/4 (1) 19.2 U 4.00 U 4.20 U N/4 (1) N/4 (2)	20.9 U
420 U 5000 U 162U 400 U 420U NA (1) 420 U 500 U 162 U 400 U 420 U NA (1) 420 U 500 U 182 U 400 U 420 U NA (1) 450 S00 U 182 U 400 U 420 U NA (1) 420 S00 U 182 U 400 U 420 U NA (1) 1 NA (2) NA (2) NA (2) NA (2) NA (3) NA (4) NA (4)	
4.20 U 5.00 U 4.20 U 4.20 U N.A.(1) 4.20 U 5.00 U 182 U 4.00 U 4.20 U N.A.(1) 4.20 U 5.00 U 182 U 4.00 U 4.20 U N.A.(1) 4.20 U 5.00 U 182 U 4.00 U 4.20 U N.A.(1) 1. N.A.(2) N.A.(2) N.A.(2) N.A.(2) S.A.U N.A.(2) 2. N.A.(2) N.A.(2) N.A.(2) N.A.(2) S.A.U N.A.(2) S.A.U N.A.(2)	3 CCO U
4 M	┝
182 182	+
420 5000 1920 4200 4200 13/4 (1) 10/4 (2)	╀
NA (2) N/A (2) N/A (2) N/A (3)	Ŧ
NA (2) N/A (2) N/A (2) N/A (2) N/A (2) N/A (3)	1
MA (2) NA (2) NA (3) NA (3) NA (3)	4
	WA (2)

(1) - Nikaled Estirs not Analyzed

(2) - Explosives Compounds not Auslyzed.

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HVVAAP - Hot Gas Priot Study Post Yest 5 - 600 Day F, 24 Hrs

				_	_	_							,									,			,		-
TOTAL	the state of the s	17.5	4.20	0	0	0	0	0	0	٥	o	10:	2	0	0	C	0	24.3	777	75.	9	258	671	4 6.4	0	0	0
J:JANIH	chlend	NA (1)	11/4 (1)	13A (1)	N/A (1)	N/A (1)	10 VA	N/A (1)	MA (ii)	N'A (1)	P/A (1)	10 4/11	IVA (II)	1VA (1)	16/Y (1)	NA (I)	N/A (1)	(1) F/A	N/A (1)	N/A (1)	(;) Y/\;	N/A (1)	E) 4/4	(I) V/!	(1) V/N	9 W U	5 50
	List	4 20 U	4 20 U	0.420 (1	31.5 U	21620 U	210 13	2100	210 U	210 U	37.A U	1 30 U	กิดเท	กังเท	១១ខេ	0.00	0315	2.00	1 20 N	1300	130 n	D 05.1	4 20 U	4 20 U	4 20 U	N/A (2)	14/A (2)
3.5	uar	4.00 U	4 CO U	0.400 U	30.0 U	الا فالتقت ع	200 U	200 U	200 U	200 U	೧೦೫	4.00 U	80 0 U	(S) O U	50 O C	60 0 U	350 U	4 00 1	1 cc 1	4 00 U	€ 00 U	D 00 +	734	4 00 U	5.00 U	rVA (2)	ET V/N
2,4,6	זאנ	192U	182.0	1.02 (1	1440	SUCCESSION OF	n oes	U 080	D oca	D OUG	172BU	192U	258 U	240 U	265.0	25.8 U	1:40	16.2 U	1920	1920	192 U	1920	1920	19.2 U	19.2 U	N/A (2)	NYA (B)
	TETHAL	D 0.73	ಬಾರ	6 00 U	37.5 U	200000 U	2500 U	2300 U	2530 (1	2500 U	450 U	20.0 U	750 U	750 U	750 U	750 U	375 U	50.0 U	50.5 U	0.000	30.0 U	50.0 U	50.0 U	5001	50 0 U	N'A S	N/A (2)
	T.	17.6	8.29	a42 U	3150	219C0 C	210 U	1 0 012	210 U	210 U	37.8 U	20.1	530 U	0000	63.0 U	63.0 U	31.5 U	24.2	7.24	78.7	3.02 J	26 6	6 71	4.64	3.06	N/A (2)	N/A (2)
÷	įJ	០០១១	0.00.3	ດຂອກ	767	30700 U	n soz	U 285	0 205	U 262	13.1 U	0 00 B	nsea	0 8 89	93.5 U	ก ร 89	44.3 U	5.50 1	S:00 U	6 60 0) 00 4	5.00 U	280 U	2 90 U	2.80 U	N/. (2)	N/A (2)
1,3,6	16.13	20.9 U	2090	2090	157.5 U	10000 U	1753 U	1053 U	1050 U	16501	183 U	2000	315 U	315 U	315 U	315 U	158 U	20.9 U	2030	20.9 U	2090	209 0	20 B U	20:9 U	2090	WA (2)	NA (3)
	XCH	0.650	0036	0.083.0	73.50	D 00214	466 U	780 C	450 U	U 063	69.2 U	0.60 U	147 U	147 U	147 U	147.0	73.5.0	9.km (s	D 03.6	J 08 C	D 69:0	0.60 U	9.80 U	U 08.0	D 08 6	N/A (2)	NA (2)
	Jim'X	127.0	1270	1.27.0	06:39	6,050 U	U SEA	ದುಽ ಬ	635 U	USS	114 U	127 U	191 (1	191 U	191 U	191 U	05.3 ()	1270	127 U	1270	1270	1270	127.0	127.0	1270	N/A (2)	N.A (2)
	U.T.	Take to	Total	CV/CY1	Totalua	Tailed	Totalog	Tuelun	Todas	Totales	Total up	Total ug	Total	Total up	Totalg	ומשותם	On Proj	TOLIN	Tackey	Totalug	Joint up	Totalog	Total	Tolking	Total up	fotal up	Total
	LATENX	Wave	J.W.	ర్జె	PA: ASE	RILISE	Г	HINSE	1	RITCE	ı	3dW		П	PUNSE	Ruse	PISE		3dM		WIPE	NIPE	34.%	AVE	WFE	WPE	ANPE.
	TEST ITEM	Ct WALL	CHE WALL BL	CLAY PAPE	CPFIDBLIK	MOTOR FUSE	PB 1 R1	FB 1 R2	28183	PBIR	POFIDENT	SHIPTEMEN	SEELAI	अस । ह्य	SHIR	क्षम १%	SIG FLD ELTER	SSR 2 WI	SSR 2 W2	58 2 W3	SSH 2 W4	S3H 2 WS	SSR 2 W6	SSR 2 W7	SSR 2 W8	CHIL.B WALL Y/2	SHIP LINE W2

(2) - Explosives Compounds not Analyzed.

(1) - Nazatod Esters not Analyzed.

TEST RUN 8 400°F/36 HOURS

HWAAP - Hot Gas Pilot Study Pre Test 8 - Aut Day F, 36 Hrs

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YOUN	E. C. Laure	, , , , ,	0	o	0	17.	77.4	4.6.4	211600	47.2	874	0.41		30.3	8.47	ပ	Sugar 6	(-) y (-)	F) Y;; I
dinklid	1	14.5 (9)	11/A (1)	(i) Y.H	11/- (1)	1:\v (i)	(i) Y.21	15.A (1)	(E) Y/M	E 4/2	(I) Y/(I)	NVA (1)	(E) Y/N	tV.5 (1)	(I) YA	(I) Y31	1UA (1)	130	×.63
3.4	1.1	435 U	1691	210 U	210 U	4 20 U	((()	4 20 U	US10 U	4 20 U	4 20 U	4200	G510 U	4:30 U	4.20 U	C5.1 U	65111	11'A (G)	N/A (2)
2,6	De. ST	400 U	1800	200 U	200 U	4:00 U	400 U	7 00 T	00023	180	4.00 U	40.0 U	6200 U	4.00 U	4.00 U	6200	0.029	N/A (2)	WA (3)
2,4,6	Tist	0ن،،،۹	86.4 U	D OOB	9.30 U	34.9	1620 U	19.2 U	211500	19.2 U	144	102 U	237700	1920	42.8	237.6 U	105050	N/A (2)	NA C
	TETHY.	الاستع	225 U	2500 3	2530 U	63	00.39)) OS	175.00 U	33	1 03 10 03	009	77500 U	J 03	50 U	USLL	750 U	N/A (2)	N/A (2)
	N.a	4:30 U	1890	210 U	210 (1	7.30	423 U	13.7	6510 U	18.7	10.7	420U	0310 U	34.3	38.8	65.1 U	651 U	N/A (2)	N/A (2)
4	Lvid	กษา	27.0 U	25.5	285 U	21.1	f: 053	0.028	6143 U	U 58.8	0.00.0	nom	00016	5.90 U	S.90 U	U2.5U	D 516	N'A (Z)	WA (2)
1,3,6	Tr4	n ecca	กราช	1030 U	10:50 U	20.0 U	D OMOZ	20.00	35500	2090	2002	0 828	3,600 U	2090	20.0 U	328 U	11 कट्ट	NA (2)	NA (2)
	FUX	967	44.10	450 U	100	000	0.08.0	7330	15570 0	28.6	7 03 6	1470	16200	∑ 0€.8	2000	1521)	1620 U	N/A Z:	MA (2)
	Yi Y	12300	57.2 U	กรรา	U SCO	623	1270 U	12.7.0	UC2C1	0.12.3	650	127.0	19700 U	1270	1270	U 721	U 0781	NYA (2)	WA (2)
	UL.YS	5/7	Total	ומיזונים	Total	Total	Totalio	Car us	Tage	1026.00	73.4.55	Total La	724.55	Tealug	On Project	Total up	Totalug	Totalug	Total
	LATHE	100 100 100 100 100 100 100 100 100 100	光光	PASSE	E ISE	3dVA	MPE	Wipe	FUSE	N.Y.E	X,PE	NA.S	F. 25.	¥2.4	Edw.	H-1SE	FEASE	WPE	WE
	TEST TIEST	CLAYFore	CPFIDENK	P8 1 R1,R4	PS & RIMA	TAN ENTER WIT	SHED LINKE WI	SAFIDENSE	S.A 1 8PK	SSR 1 WIM4	SSHIWSW	85H 1 WSWI	S.R.Z.S.P.K	SS-2WIMA	SCA 2 WEANS	SP WAX	SPWAX	St. L. J. K. W.2	STELDELIK

(1) - Nivated Exiant nut Analyzed.

(2) - Explosives Compounds not Analyzed.

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HWAAF - Hot Gas Pilot Suidy Foat Taul 8 - 400 Day F, 36 line

			Ψ-	,		<u>,</u>	,	,	·			, .	,			.,,,,
TOPAL	Exert Courses	0	0	0	3	9	0	0	ت	0	0	0	3	(c) V:1		27/1
O'AL TEO	Cale. in	E VX	NA (B)	1./A (E)	SYN	SYN	N.K.:	WA (1)	E VN	N/A (S)	E YN	N/A (3)	N/A (1)	7.60	2 10	5 00 U
2,4	DAIT	5200	4.20 U	28.5	7 20 0	1.80 U	4.20 U	1 30 0	1.20 €	210 U	210 U	210 U	210 U	N/A (2)	N/A (3)	NA (2)
2,6	מית	100.4	1007	7007	4.00 U	11 00.1	D 00.3	7 00 7	7007	200 C	200 U	200 C	230 C		×	N N
2,4,6	THE	19.2 U	19.2 U	19.2 U	19.2 ()	19.211	19.2 U	19.2 U	19.2 U	D 098	0 096	D 096	D 096	N/A (2)	N/A (2)	N/A (2)
	TETANL	50.0 U	0 0 03	50.0 U	50.0 U	SO.0 U	50.0 U	50.0 U	20.03	2500 U	2500 U	25:30 U	2500 U	N/A (2)	NA CO	N/A C
	1:0	4.23 U	130 C	4.20 U	430 €	1200	4.20 ∪	120 ∪	4.20 U	0.013	2100	210 U	2100	N/A (2)	NA (2)	WA (2)
41	7.3	8 20 U	6.60 U	8 B0 U	5.60 U	6 20 U	5 90 U	5.80 U	5 50 U	U 583	205 U	295 U	265 U	N/A (2)	(Z) Y/N	N/A (2)
3,5,8	This	20.0 U	20.9 U	2000	20.9 ∪	20.9 U	20.9 ∪	20.9 U	20.0 U	1050 U	1050 U	1050 U	10%0 U	N'A (2)	N/A (2)	WA (2)
	FOX	D 59.0	D (23 G) (2)	3	D 08:0	U 08.0) OS 6	0.60	450 U	150 U	203	450 U	N/A (2)	N/A (2)	WA (2)
	HEEK	12.7 U	127 0	12.7 U	11.70	127 U	(27.0	12.7 U	12.7 U		635 U		635 U		WA (2)	N/A (2)
	Usin 18	Yearisa	Total	Total Us	िया एव	Total to	Toulus	िवज्र । १५	Total to	Total up	Total up	Total UG	Total ug	Total up	Total up	Totaleg
	MATRIX	WATE	WFE	WE	WPE	WFE	WPE	WPE	WPE	RINGE	NASE	FIFTSE				WPE
	TEST MEM		SSR 1 WZ	SSR 1 W3	- †	SSR I WS	SSR 1 WB	55R 1 W7	SSR 1 WB	SPRI	SP FF2	SP R3	SP F14	CHAIB WALL WZ	SHIP LYKE WZ	SMFLOBISK

(1) - Nitrated Esters not Analyzed.

(2) - Explosivis Compounds not Analyzed.

HWAAP - H. M. Gas Pilot Siedy Post Test 8 - 400 Dag F, 30 Hrs

					1,3,6	Ÿ			2,4,6	2,4	4	4mYHATEO	TOINT
TESTITE	MATHIX	SURIN	HASK	NON	Tric	Dia	N3	TETHM	THT	Dist	Dia ^x	tilians	EAFT Commen
BEALTH FLISE	RUSE	Talus	153 U	123 U	2 ಚಿ	0867	52.5 U	U 524	240 U	\$0 O O	52.5 U	(L/A (1)	0
CLEAR WALL	ije"M	Salar		9.80 U	D 6.02	n 03 \$	4.20.5	53.0 U	18.2.11	4001	1 SO C	NA (1)	0
CIKIB WALBL	WPE	Totalug		∩ 09 €	N 8 02	0.03.8	4.20 U	50.0 U	19.2 U	4.C) U	₹ 20 10 10 10 10 10 10 10 10 10 10 10 10 10	(i) V/2	0
CLAYFFE	SOF	g/cn	1.27 U	E (230	2090	0.55.0	0.42031	200 U	5.03	0 6050	0 430 C	N.A (1)	6 53
CP FID BUNK	FRISE	Total ug	U 621	nezi	U EAS	ารเวบ	525 U	825 U	240 U	50.0 U	52 S U	H/A (II	0
PB 1 H1	100 25	Totalus	U 583	450 U	1356 U	ละฯ	210 U	2500 U	1130	200 U	210 U	E) V/2	135
PB 1 R1 DUP	RESE	Total up	0 553	N 994	U OSO1	205 U	210 U	2533 U	126)	Sig U	210 (NA (4)	12.0
98182	RYSE	Total up	U 203	f) 085	1050 U	N 50Z	210 U	2550 U	O 033	200 (1	210 (1	14/4 (1)	0
PB 1 R3	RAISE	Totalus	035 U	D 034	0 0301	20%	210 U	2500 13	0.038	38.0	210 U	117.4 (1)	o
PB . PA	PEASE.	Total	U 559	450 U	1630 U	295 U	210 U	2500 U	1 008	200 U	2100	[] FWA []	0
Pazni	PESSE	Talle	0 909	450 U	10331	255 U	210 U	2530 11	D 096	ء دي	2130	E) VA	0
Pazez	RASSE	20.00	U 200	₩ 1000	1030	(4. t)	210 U		930 U	200 C	210 C	15 AN -	ບ
5000	Toyat.	TOTAL LO	U SYS	400 U	1020 U	D 208	210 U	7 005%	n oee	ာ လူ	20.00	EV VA	٤.
FB2RA	35.3E	Total up	U 250	O 087	1050 U	U 205	210 U	25.00 U	0 033	2CO C	21311	NA (3)	,
SUP LAKE WI	WPE	Total up	127.0	D 08:8	20.91	D 08-S	4.20 U	50 0 U	19.2 U	ე 00:₹	4 20 C	17.4	0
SHATE	TENSE	Totaling	191 ()	147 U	31511	86.5 U	63 O U	750 U	263 U	D 0.09	0.00	N.A (E)	0
SH I P2	PRISE	Talug	0 131	147 U	315 U	กรเช	83.0 U	750 U	26a U	60.01	6300	117 (3)	0
SHALES	PLISE	Totalisa	U 101	147 U	ารเร	US 88	ស្លា	750 U	£38 U	60.C U	63 0 U	11.4 (1)	0
SAIR	RUSE	Tolling	191 U	147 U	315 U	6a.s U	00.00	750 U	268 บ	0000	030 C	N/A (II)	0
SHATELER	PELSE	Total up	391.0	147 U	315 U	บ ร อร	NS.0 U	750 U	289 U	60.00	000	(i) Y/A	O

(2) - Explouives Comporants not Analyzed.

(1) - Hikuted Estar not Analyzed.

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TEST RUN 13 500°T/12 HOURS

hWAAP - Hot Gas Pilot Study Pre Last 13 - Ew Evy F, 12 Hrs

			T	_	7	7	<u> </u>	1	7	ï	T	7	7	Ţ	_	_	_	7	_	
10.0	-	1	2/3	26.5.5	Carried 4	0	0	0	o	4 40	,	0	0	2	0	125	0	6.7.4.4	Y. V. I	
MITALED	10 4/14	NAS.	NA C	SYN	EVY (E)	E YA	E YA	12 A (3)	F.X.S	NA CE	N.Y.E	N/A (:)	EVY	EN Y/N	15	11/A (1)	11/ Y/H	12.8	5000	
-	24.50	52.30	878	26.50 U	42CC U	5240	210 U	2100	50.5U	43.7	7319	102+	4 20 C	780	1200	133	7000	NA (2)	N/A (2)	
2,6 5,01	100g	SONO U	25.0	D COOS	1000	4300	003	200	2000	284	7eco U	1004	180	720 U	7.00 €	384	285	N/A (2)	N/A (2)	
2,4,0	24500	6000	243011	7230.29	805030	230.411	nc.g	1) 050	D 047	1920	302000	19.2 U	1920	8w000	19.2 U	19.2.0	1920	KVA (2)	N/A (2)	
1634AL	U GC SZ	O COSTO	U NESO	62540 U	£2000 U	D 009	2500 U	2:00 U	625 U	0000	U 02:14	S0.0 U	20.00	9000 U	50.0 U	0.005	2000	14'A (2)	N/A (2)	
Z)	V 25.7	<u> 0 0528</u>	525 U	5250 (1	4200 U	5040	210 U	210 U	52.5 U	1.20 U	0.0010	4.2011	3.33 J	756 €	4.20 U	8.28	2.64.3	N/A (2)	N/A (3)	
4.3	USS	75.20 U	73.8 U	70,000	6,000 (1	70 B C	25.5 U	अस्य ।।	73.0	5.00 1	11500 U	5.90 (1	5.83 U	1080 C	5.k0 U	5.CO U	13 00 5	N/A (2)	N/A Z	
1,3,6 Ti5	3.00	10000	2850 11	£3300 U	1) (1) (1)	252 U	1050 U	10501	263 U	20.0 U	41COO C	20.00	20.9 U	3760 U	39.0	20.5 U	20.9 U	N/A (2)	HVA (2)	
Fux	122.0	125.00 U	1250 U	12300 U	D OCES	2002	285	450 C	1230	000.0	20.00	0330	3	1300	0.030	230	0000	11.A (2)	NA ED	
HEEK	1633.0	15500 U	1550 C	1500 U	12700 U	152 U	35.0	ಚಿತ್ರರ))	57.7	24603 U	1270	1270	225.3 U	1270	1270	12.7.0	NA G	MAGI	
ST. ST.	1,4,4 (5.)	Takes	Tolato	ST CO	c/m	10. P	1c 12 150	14.15	108 US	Talana	रियंख फुउ	Total Up	10(81)	100 kg	S	Tula 1173	Takes	ໄດພີໝ	1017107	
ELA') F.J.K	7.00	35.75	 .⊋	25,45	80	NA PARTIE	-	Ŧ		- 1	- 1	¥.	A.	7	W.P.E	WASE.	W.E	WFE	No.	
Teurmen	181	157	AP 2	VP 2	CI All Pare	S B B B B B B	701 P1/R4	F8 2 H1/R4	PBFIDBIA	Str. V. LE V.	No.	53. I WI/W4	MANA N	200-12 PK	SE SWIME	S. Y. Z WS.N.B	SAND OF RES	Ship Live W2	SWEDGIX	

(2) - Expressives Compounds not Analyzed.

(I) - Niculaci Estura not Analyzad.

HWAAP - Hot Gas Pilot Study Fost Test 13 - 500 Day F, 12 Hrs

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TOTAL	Excitatives	0	0	0	0	6	6		0	3	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0		12/A (2.7	11/2/17	N.A.E.
galivane	èu) cred	N/A (1)	(E) 424	(B) Y/12	N/A (3)	15 4/2	11) 7/14	(E) V/(4)	E VA	NA C	10/4/10	E YN	30	EVA (1)	MA (II)	N/A (1)	SAN	PVA (S)	EVA (S)	E V/N	E) Y/7!	E YN	E YA	N/A (E)	10.4 (1)	3 4/2	MA (III	F/A (1)	389	5000	3.5
24	Dist	210 U	210 U	210 U	210 U	4200	4 20 C	043011	5250	210 U	210 U	210 U	210 U	52.5 U	4.20 U	0.00	D013	6300	S3.0 U	5480	4.20 U	1 20 C	7.30 U	4 20 U	4 20 U	4 20 11	D 022	4 20 0	WA (2)	NA (3)	N/A (2)
2.5	1050	2230	2007	2000	2002	7 00 T	7007	0.400 U	0003	200 C	25.5 25.5 25.5 25.5 25.5 25.5 25.5 25.5	2000	200 U	0.03	4.00 U	53.00	0.03	0.03	60.00	\$2.0 U	133.4	4.00.0	4.CO U	4.00 U	4.00 U	1.00.4	4 SO U	4 00 U	EVA 33	14/A (Z,	1VA (2)
2,4,6	THI	F: 00:3	U CAR	D 096	0 026	19.2 U	16.2 U	1.74.3	240 U	D 888	D 095	D 096	n cad	240 U	18.2 U	288 U	203 ()	283 U	238 ∪	250 U	18.2 U	19.2 (1	:9.2 U	19.2.0	192.0	17.4 J	1920	192U	N/A (2)	N/A (2)	N/A (2)
	TETHY	25CO U	2500 U	2500 U	D GOSS	50.01	20.00	5.80	625 U	2500 U	2500 U	2300 U	2500 U	R25 U	50.0 U	750 U	150 U	750 U	750 U	U OSB	50.C U	SO.0 U	50.0 U	20.0 €	20.00	50.0 U	50.0 U	S0.0 U	N/A (3)	N/A (2)	N/A (2)
	2.0	210 U	210 U	2100	210 U	4.2% U	02.¥	0.4201	525U	2100	210 3	210 U	210 U	62.5 U	4.20 U	C30U	00.03	0009	20.03	54.8 U	4.20 U	4.20 U	D 05:+	4.20 U	28.4	4:00 U	4 20 U	4.20 U	N/A :2)	N/A (E)	N/A (2)
4,1	653	U 5.23	503 (1	205 U	203 U	5.90 U	8.30 U	0.520 U	7175 U	285 U	295 U	235 U	⊃ 552 C	73.0 U	D 03.3	88.5 U	83.5 U	83.5 U	89.5 U	76.7 U	2800	2.83	2800	2.80 C	233	233	2.90 U	5 to U	N/A (2)	11/4 (2)	N/A (2)
1,3,6-	Trees	1030 ()	10:0 U	1050 U	1050 U	20.9 U	20.0 U	2000	233 U	1050 U	1050 U	1050 U	1959 C	263 U	20.02	315 U	315 U	315 U	315 U	273 U	20.00	20.9 C	2000	20.9 U	20.00	20.90	ე 8	2080	N/A (2)	NA (2)	N/A CO
	F.DX	4:00	450 U	D 03≯	450 U	D 09.6	9.80 U	U 063.6	123 U	450 C	D 052	708v	203	1230	33.0	147.0	147 U	147.0	147.6	127 U	080	೧ಚಾ	ට 330	000	9	0.00	6.09.6	ე: 0:00	N/A G	N/A (2)	N/A (2)
	IštaX			635 U			127 U	1.27 U		635 U		635 U	635 U		12.7 U	191 C	13, U		7.10			127U	1270	1270	1270						N/4 (2)
	85.50	[लानका	Tetal us	Town up	Total us	Talding	Totalug	เ _{/5} ก	Totalug	Total un	Total up	Total	Talled	Teke' ug	Total typ	Total US	Can up	Total	Total US	Total up	ומיין וויט	00 FE	97.77	Can es	Gan re	Bri 100	100 trū	Total up	Del terr	TOTAL US	lote tro
	SATE	FL:E	FU ISE	300	RASSE	WPE	Sept.	ğ	RIBE	RYISE	20.75	200	A SE	KAISE	A.VibE	EN SE	RASE	RNSE	7	355	N. W. C.	3	2		¥ .	North Control	WIFE	A.P.E.	1 K	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WYE
	TESTITEM	k2 R1	7. KZ	₹ 2	JFR4	CHILL WALL	CHIL'S WALL BL	CLYPIPE	CP FLD. BLNK	P82R1	PB 2 F.2	782R3	PU2R4	78 FLD. 62 XX	SEP MENERAL	SESTI HI	SHIRE	SHIR 1 RO	¥ 50	STAFED BLIK	W. H.	SSH 1 WZ	SW LOS	W HOO	CW I HOU	DAN I MO	55.1 W7	SSH 1 WB	SILL MINE WZ	Crt. U WALL W.	OW TED BEST

(7) - Explosives Compounds not Analyzed.

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*** Restaured Effectament New Color

(1) - Harsted Estats not Analyzed.

TEST RUN 14 400°F/12 HOURS

HWAAP - Hot Gas Pilot Sledy Pre Test 14 - 400 Deg F, 12 Hrs

				-	<u>,</u>		₁		-,											-
TO I'M	Elet Conses	فسيوع	9	0	0	0	0	٥	503603	5.000	0	16.0	10.0	34606	32555	0	204	၁	11/4 (-)	18/V (3)
WIHALED	raicos	N/A (1)	11) V/N	WA (1)	N/A (1)	N/A (1)	EVV III	117 (1)	EW CI	MA []	N/A (1)	IVA (II)	N/A (1)	N/A (I)	EV VA	(I) (3)	WA (1)	124 (1)	2 CO S	2,001
2,4	ניינ	4200 U	52.5 U	210 U	210 U	52.5 U	4.20 U	1 30 C	188	5250 U	0.000	7.30 C	4.20 U	6300 U	445	523J U	, 20 U	4.20 U	N/A (2)	14.A (2)
2,8	Dist	4000 U	£3.0 U	200 U	20.3 U	50.0 U	1.00.1	1.00 U	500 11	3000 U	EC00 13	4.00 U	4 00 U	D 0003	500 U	5000 U	4.00 U	4.00 U	NA (2)	N/A (C)
2,4,5	TraT	ES40.00	240 U	6:00 1)	D OSS	240 U	19.2 U	1920	201003	613000	28830 U	19.2 U	19.2 U	3.0000	355000	24000 U	16.2 U	16.2 U	NA (2)	NA (2)
	TETRY.	ก ୧୯୯୯	625 U	2500 U	2500 U	S2.5 U	50.0 U	50.011	0 0523	ก ๑๐๑๕๑	U 00027	20.00	noos	J 00051	6250 U	62500 U	O 0.03	50.0 U	NVA (2)	N/A (2)
	92	4200 U	525U	210 U	210 U	U 2.28	∩ 02' ⊁	4.20 U	\$25 U	5250 U	0.0059	18.6	16.6	റ ഗജ	525 U	5250 U	25.4	4.20 C	E) YA	N'A (3)
4,	C.S.	50000	73.8 U	2350	205 U	73.8 U	5.90 U	5.63 U	723 U	73:0 U	U 028.2	5.50 U	5.50 U	8830 U	728 U	7360 U	5.80 U	5800	(S) V/N	N/A (2)
1,3,6	644	200201	283 U	1050 U	1050 U	26311	20.00	20.9 U	2850 U	23300 U	31600 U	20.9 C	30.0	315000	2530 U	23000	20.01	20.8 U	N'A (2)	14.4 (Z)
	HOX	10003	123 U	D 05+	J 037	1230	0%6	0.030	1230 U	12300 U	14720 U	008	D 63.0	14700 U	1230 U	12300 U	0.00 €	9.60 (WA (2)	N/A ES
	HEIX	12700 U	Desi	U 363	U SES	159 U	1270	12.7 U	1528 U	150,00	16100 U	127 U	1270	U COIST	1550 U	1595.0 U	1270	127 U	N/A (2)	NVA (3)
	CASTE	p/55	SA LIE	Total	On Poor	To the	Total up	Tue	Total	Total	Totaluo	Tag up	במיין ונט	Tellug	Total US	Total ug	TGalun	Told up	Tastun	Takelug
	MATEUX	ğ	FLISE	ESSE	RESE	APISE	Wive	MPE	FAISE	FEFTSE	RUBE	W.P.C	MPE	PANSE	SWE	FUNSE	WIPE	MPE	MPE	WIPE
	NEST TREM	CLAY Purit	CP FIO RINK	PR 1 RIVED	F32B1R4	PB FLD. BI NK	IM STEN OF IS	S. IFID BLAK	SSR 1 SPK	SSR 1 SPK	SSH 1 SPK	SSR 1 W1AV4	SSR 1 WEAVE	SSR2SPK	SSR 2 SPK	S. A 2 SPK	SSA 2 WI W4	SSR 2 WSAVA	SHIP MILE WZ	SHIDBINK

(2) - Explosives Compounds not Analyzed.

(1) - Niras of Easts not Analyzed.

HWAAF - Hot Gas Pliot Study Post Test 14 - 400 Deg F, 12 Hrs

								_			- -		-		_	 .	_														
TOTAL	£. 210	٠	0	0	0	0	6	6	0	0	6		100	4.00	0		-	3	0	0	0	9	0	0	9	0	3	0	1.5 (2)	(2) + (2)	1: A (-)
Galvela	4117777	(I) V/7	15,A (I)	167 (3)	N/A (3)	17/4/11	(I) Y/!	N/A (I)	10,4%1	EV VA	EVA E	NA (1)	E 4/2	E VN	17.7 (3)	(E) Y.7!	15 KM	11.4 (3)	E	12.5 (3)	12.5 (3)	12.X (E)	E YY	184 (1)	EVN	11.7 (3)	IN YAL	E 4/1	3.00 0	20.3	5 00 3
7	Sr. T	0073	0.55.0	£2.5 U	210 U	21013	216.11	2100	\$25U	4 20 U	3		52	7.5	52511	nu.	4 20 0	4500	4200	1300	1004	0 02 +	1284	210 U	21011	2100	210 U	7 20 0	NX (B)	N/A (2)	HVA (C)
2,4	DMI	100.4	D 500 O	20.03	2000	מאנית	D (3)	13	200%	180	0 0 0 0	200	ness	11013	50.0 U	4.00.1	1 00 t	1 00 T	4.30 U	1 00 T	4.00 U	1001	+ 80 €	2000	2000	220 U	200 U	234	N/A (Z)	N.A (S)	NA (2)
7.4.6	Tier	102U	1.82 U	240 U	D 000) (33 (33	2033	0.03	2400	1,20	23.0	6450	315	3360	7 O T Z	1520	19.2 U	1820	1920	1920	19.2 U	19211	1520	() 05:5	n 033	٦ ن	1000	10.2	NA (2)	N/A (2)	N. C
	TETHIR	0.000	S.C.3 U	ns.	U Griss	255.0	25.00	2500 U	6.50	0 3 04	75°U	រនាប	1501	750 U	US:0	Sout	೧೦೧ಽ	50.03	0003	5000	50.5 14	5000	£30 U	2530 U	25Gi U	25.00	25.00	500U	NA(E)	PUA (2)	1:A (3)
	N.S	4530	0 (30.11	0:2:	21001	2101,	210 U	210 U	5250	3.20 U	เลงบ	เรอบ	200	nors	U \$ 28	1 20 U	4 20 U	4 20 U	4 20 U	1300	1 30 C	120 C	೨ ೧	210 U	210 U	210 U	210 (1	4300	N/A (E)	N/A (2)	N/A GO
4.	ເນາ.ຜັ	6.k3 U	0.so U	73.0 U	2250	25.0	225 (1	255	OREL	5.50 U	62 S U	6830	0.5 W	9950	7360	3.03	5.60 (1	28.C	5000	5 82 U	2.50 U	رج ت	5.00	255 U	255 U	20517	365 U	55 C2	1.5 (2)	14.4 (2)	NA (3)
1,3,6-	Ind	ಬಾಗಿ	2 . U	263 U	10330	1050 U	10:00	1050	243 U	2000	659	1 210	25.5	0.816	⊃ (78	27.2) e 02	20.80	D 6 02	0.603	20.9 U	20913	0.00	10:01	10:00	1050 U	1650 U	0.803	NA (S)	N/A G	NA id
	нох	0.03.0	0030	123 U	430 U	150 U	1004	45013	123 ប	6.801)	6350	6,370	2000	610	1230	280	D 08.€	0.83))	U 08 6	280	3	D 03-6	100.0	2 S C	33	330	D 001.0	10/4 (2)	NA (2)	NA (2)
	Year.	12.7.0	1.27 U	150 U	\$35.0	0.35 U	G35 U	635 U	150 U	127.0	732	720	450	204	150 U	26.36	1270	1270	1270	127 U	127U	12.7.0	12.7 U	£35 U	635 U	ָר ר	D 55.0	12.7 U	NA GO	N/A (2)	N/4 (3)
	UZATS	प्रशास्त्र	cyco Color	Totalua	िखब एउ	Total up	Total tug	Total ug	Colub.	FOLLID	Tara tua	Total U.J	Total UD					Tc14 193	TOTAL IN	20.00	100 100	Total up	Total up	C	10000	TO X (12)	िंडी धरी	द्धा प्रा	Tद्ध्य एव	বিভাগ্ন	TCa us
	LATRIX	3cm,	SQL	PENSE	記念	PUISE		FUNCSE		¥F.	1	ī	E STE	HISE.	FEISE	WiPE		7	<u>د و رو</u>	i	¥.E	T		ī	. 1	RUSE			i	1	WIPE
	TEST (TEM	CHILLID WALLE	CL 2Y PIPE	CP FLD. BLAX	FB : R1	PB 1 R2	Pið 1 R3	PS 1 FM	PB FLD. MISK	SHIP MILLE WI	Siffin	अझ । हर	211035	SH184	SAFID SIK	SSR 1 Wi	SSR 1 W2	SSR 1 W3	SSR 1 W4	SSR I WS	35H 1 W6	SSR 1 W7	SSR I WB	SPRI	SF 72	SP F3	S. R.	WALL FID BIK	SHIP KILLE 4.2	CH43 WALL V.2	SM FLD BLYK

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TEST RUN 15 500°F/12 HOURS

HWAAP - Hot Gus Pilot Study Pre Test 16 - 6w Dog F, 12 lite

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TOTAL		7	Be 5 ve	5.4	27.0	16:000	0	0	G	0	8	0	9:1	20.00	222	7	0	27000	5-9	113	62.4	53.2	25.5	1.VA (2)	N;74 (2)
Gairmin	Laste 4	10.50	(E) 554	E 4/1	(*) 4.°	() Y ()	(1) Y/N	(1) Y.71	KS (1)	(I) V/2	(1) Y/H	(E) 4/H	(E) 431	(E) X.51	14.4 (1)	HA (E)	(E) Y.T.	(I) V/I	12/4 (i)	(1) Y/N	(i) Y/N	(·) Y/N	1:/A (1)	6.69	၁၀၀ၭ
4,	inf	, aci	D 0003	013	5250 U	13000	525 U	32.5 U	210 U	210 U	7.47	4 20 U	8351	8313 U	450	100 t	1830	ESCO U	203	D 06.3	24.9	3.30 J	420 U	N/A (2)	(S) 4/N
9,4	Buff	0005	50001	500 U	U oose	الانتناه	50.0 U	50.00	260 13	200 U	4.03 U	n 00 r	0 00 8	ח פניאס ת	009 O	1.00 U	4.00 U	9530 U	600 (1	e 30 U	1.00 U	4 00 U	40 O U	N/A (2)	N.A (2)
2,4,6	TisiT	2.00	وسوسية	2400 U	Bishil	687000	240 U	240 U	0.413 J	800 U	106	10.1	24 B U	32,000	2530 U	8.4u J	16.5 J	2700.00	2800 U	2a.6 U	10.1 J	93.8	192 (5	N/A (2)	N/A (3)
	TETAN.	กระก	0.570 11	U 0253	C25C0 U	50,000 U	C25 U	625 U	2500 U	2500 U	D 0:09	50.0 U	7503	75006 U	7500 U	50.0 U	5001)	750.00 U	7500 U	75.0 U	50.0 U	50.0 U	5:0 U	N/A (2)	NVA (2)
	133	525U	5250 U	525 U	5253 U	4200CU	52 S U	52 S U	210 U	210 U	1.2.3	1200	0 35 U	0 00 E3	0.00.9	4.20 U	4.20 U	ಬಹಣ	D 053	8.30 U	4.20 U	4 20 U	420 U	N/A (2)	N/A (2)
4.	Chis	73.8 (5	736,00	13306	7385.0 U	500.000	ಗಾಶಲ	738 U	235 U	295 U	2.70 J	5.90 (5	8.53	8350 U	Bas U	ខល៥	O 03.5	0.0500	8651)	3.0	5 50 U	2801	59.0 U	N/A (2)	N/A (2)
1,3,6	TNE S	35.6 3	0.0000	್ವಾತ್ರಾ ೧	U 00055	205000 U	183.0	ನವ ೮	0.5.5 U	1050 U	23.9 U	20.9 U	26.3 J	015.00 U	3150 U	20.6 U	20.0 U	315/00 13	3150 U	20.4.3	20.9 C	20 B C	203 C	102,371	N/A (2)
	XCY	116.1	12530 U	240 3	U (0052)	U OCCUS	าธะเ	12311	450 U	11 037	9.6 U	0.69	110	14700 U	1470 U	9 85 U	0.000	14700 U	1470 U	103	41.0	0.66.0	2116	F1/A (2)	N/A (2)
	PALK.	10.01	15500 1	1550 U	15500 U	1270.00 U	159 U	159 U	6 15 U	6.5 U	127 U	127 U	19.1 U	19100 U	1910 U	12.7 U	12.7 U	19500 U	191 U	19.1 U	28.€	127 U	528	N/A (2)	NVA (2)
	ดะเกร	Tead to	Total (N2)	Total	Total on	E/On	[Cotal Us)	Con Project	Totalus	Total	Total ug	Total un	Total ug	Totaling	Sual w	Tead up	Tailing	Total	Total	Total un	ીંબલ હતુ	Total	Total ug	Tatalug	ित्यं एत
	LATELA	Fui ece	FLISE	BSt. LP	P: SE	Š	PiriSE	PlinSE	HINSE	RITSE	MA-2K	301.4	RUBE	RIVSE	PUTSE	HAISE	¥,ĭ₽E	PETCH TOTAL	RINSE	FLISE	WAPE	WFE	WiPE	NIPE	N.PE
	TESTITEM	API S FuiSE	AP1 S FLIXE	JP2 S RIVISE	AP2 S FattSE	CLAY PIPE	SPECO BY	PC FLD BLNK	PB1 R1/R4	P52 R1/N4	SHIP NINE	S.M.FLD. BLINK	SSR1 PULSE	SS: PUSE	SSA1 RUSE	SSA1 WINIA	SSH1 WSW8	SSR2 FILISE	SSN2 Pit.SE	SSR2 Puise	SSR2 W1/W4	SSR2 WC/WB	SSR2 Wo/w8	SHIP MILE WZ	SM SLD BLIJK

(2) - Explosives Compounds not Aualyzad.

HWAAP - Hot Gas Filot Study Post Yeat 15 - 600 Degr F, 12 Hrs

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	TOTAL	Ehrichmen	0	0	0		9	9	0		0	٥	a	6	,	10.A (2)	A/A (2)	BUA (2)	
	MINATED	E611.43	E 74	E Y/	E Y/N	11/18		(E) V/91	E YA		1	PVA (1)	N/A (3)	N/A (5)		3.00	5.00 U	7.53	
	4,5	Direct	1.30	4.20 U	2 8 7	11027		3	1.40 J	1 40 1		1.40 J	7.20 €	1.50 J	A114	10 70	NA CO	N/A (2)	
	2,6		200	1.20 3	4.S	4.00 U	187	3	4.03 U	4 00 11		3	4.00.0	38.	ALIA I'M	5	N/A (Z)	N/A (2)	A
	24.6		2	3	1.40 J	1.00	2 68 2		3	2 30 J		200	2.36.7	28.5	W Win		12 VA	NAG	
	5212	1000	1000		20.02	20.08	1100%	1	20.00	2000	1000		2000	2000	NIA (S.		200	N/A (6)	- KI TIN
	g	11001	200.7		25.0	20 C	4.20 U	18	0.03.6	28.5	4 20 11		200	4.20 U	N/A (2)	12.12	3 5 5 5	77.57.2	
	4.5	11034	199		3	586	2900	1000	2	283	1000		2	2000	NA CO	NIA 73		100 000	
	1,3,6 EVIT	1000	300	1000		06.05	30.90	2000		20.80	0.602	25.0 11	2	2000	<u> </u>	N/A F.N	N/A	120	
	HOX	0.038	0084	11000	3	200	200	11036		200	08.6	= 040		3	NA B	N.A (2)	N/A CA	1 2 2	
	HEX	12.7 U	12.7 U	12711		26/20	127 U	1270		16/0	1270	12711	11/269		N/A (2)	WA (2)	N/A CS	4-	7
	ST!MO	35 E	37.72	Total text	2 2 2 2 2 2	5	Total un	िट्टा स्थ	1	8	Total (N)	Contactor	1.27.74	7	52 53	いったさ	TCAIN	Cat Like	
	MAYNIX	WIFE	STAN	MAPE	DONA	-	WPE	SYPE	KADE	3	WPE	36.84	1107/2		NI L	HAPE.	WPE	ï	
	TESTITEM	SSRIWI	35R 1 N/2	SSRING	77% 1 G 3 S		SSH 1 W.S	SSR 1 W6	SSP 1 W7		SSK 1 WB	SSR FLD BLNK	WALL FLO BLAK	W1 2112 G173	STUP NINGE TIE	SM FLD BL ! AK	CHAIB WALL M2	CHAIR WALL BLINK	

(1) - Hitzaed Catera not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gos Pilot istudy Post Yout 16 - 6th Dog F, 12 His

False Load of Section Total of Section Tota						1.3.6-	4			2,4,4	4	2.4.	32134758	Jeist
Failice Total Light Color Colo	TESTITED	MAGRAX	רייוצ	X Y	FDX	These	0.10	g	TERRIT	TraT	DixT	CuT	4. 8.8 2.4.48	Ent toberone
Fairse Total and Gast U 450 U 1650 U 285 U 210 U 2500 U 350 U 200 U	AP 1 R:	37.12	T. 4. 4.2		45.0	1050 U	2350	21019	2.00 U	160 U	200	210!)	10,470	o
PAUSE TOLALUS ESS U 450 U 1050 U 295 U 210 U 250 U 350 U 200 U	W IR	FLISE	Total to		283	1650 1	D 5.55	210 U	2.00 U	500 U	200 נו	21012	N/A (3)	ũ
Name Total or 1550 1500 1650 1650 150	AP 1 83	PELISE	Total land		496 1	1050 U	285 U	210 U	2500 U	J. CO.	೧ ಬರ	2:0 U	NO (1)	9
Marke Totaling 155 U 127 U 265 U 126 U 126 U 126 U 126 U 127 U 127 U 127 U 127 U 127 U 127 U 126 U 127 U 1	¥1-84	PASSE	To a so		780	10.50 U	295 U	210 U	2:00 0	U 059	20:0 U	210 U	(i) 4/M	ت
Mark Total of 127 U 9 Es U 209 U 0550 U 040 U 150 U 150 U 0400 U	AP FID BLIK	FUSE	Total up	159 U	12/0	263 U	73.8 U	52.5 U	กระม	240 U	0 0 cs	5251	N/A (E)	0
Further Further Light	CHUS WAL WI	WIPE	Totaling		U	20.9 U	S.50 U	4.70 U	೧೦೦ಽ	1.60 J	OO 7	1.50 J	1 1/4 (1)	O
Harse Total up 155 U 125 U 125 U 255 U 125 U 250 U 2	CAY PIPE	#338	15.52		U GOO	2.09 ∪	U 550 U	0.450 U	5 30 U	1.52 U	U.500 U	C 420 U	NA (1)	ر م
Name Name	COFFORM	i	Totalua		123.0	263 U	73.6U	5250	O SER	240 U	S0.0 U	52.5 U	NYA (1)	0
Harding Totalug 635 U 450 U 1050 U 205 U 210 U 200 U	PB 1 R1	ı	TCE	0550	45619	10501	265 (1	210 U	ດຕະເ	D 033	O02	210 ()	(I) Y/13	o
Harist Tolaing	50182	25. AS. ES.	Total	33 U	1004	10501	203 U	210 U	D 0025	U 053	20¢ U	2100	N/A 11	0
Name Total of State 150	3-6	PASSE	ST 12	U 808	1 037	10501	295 U	210 U	2500 U	D 00%	20C U	2101	11/4. (1)	3
No. No.	E S	PAISE	Tcletup	0350	7 03	1050 U	20.5 U	210 U	2500 U	060 U	200 C	2:00	N/A (1)	0
WI WPE Total of 127 U 600 U 200 U 420 U 500 U 1,00 J 400 U FMISE Total of 101 U 147 U 315 U 885 U 630 U 750 U 260 U 600 U FMISE Total of 101 U 147 U 315 U 685 U 630 U 750 U 266 U 600 U ALK FMISE Total of 101 U 147 U 315 U 685 U 750 U 266 U 600 U ALK FMISE Total of 101 U 147 U 315 U 685 U 750 U 266 U 600 U ALK FMISE Total of 101 U 147 U 315 U 685 U 750 U 266 U 600 U	PBFIDGIX	303	Total	159 U	១៩	283 U	7380	N S 23	8.35 U	240 U	O 0 04	1280	NA (1)	0
Number Totaling 191	Ship Marie WI	WPE	Total . to	1273	0 00 1	20.0 U	5.90 U	4 20 0	2000	1.50 4	7 00 1	1.70 J	1.7A (1)	ن ن
Filter Total 1910 1470 3150 6830 500 7500 2680 1885 Total 2 1910 1470 3150 8850 6300 7500 2680 314K PRINSE Total 2 1910 1470 3150 8850 6300 7500 2660 314K PRINSE Total 2 1910 1470 3150 8850 6300 7500 2660 315K PRINSE Total 2 1910 1470 3150 8850 6300 7500 2660 315K PRINSE Total 2 1910 1470 3150 8850 6300 7500 2660 3150 3150 3150 3150 3150 3150 3150 315	SIBIRS	PW-ISE	Totaling	191 3	147 U	315 U	88.5 U	3000	១នេះ	283 U	ာ ၀ ဇ	63 O U	NA (I)	þ
FRUSE Totalog 1610 1470 2150 6850 7500 2860 State	SHALRZ	FUSSE	Total	191 U	147.0	315 U	88.3 U	ES û U	75.0 U	26.8 U	D 0.09	6300	FUA (1)	0
MAK PRISE TOWN 1910 1470 3150 6850 6300 7500 2480	SER 1 R3	381%	Tollug	161 U	147.U	215 U	Ca 5 U	0 0 E 9	753.0	286 U	N 0 09	63.0 U	N/A (1)	ŋ
X PRISE TENNIN 1910 1471; 315U 885U 630U 750U 265U	SIRIS	RUISE	Total US	191 U	147 U	315 U	88 S U	E3.0 U	753 U	2⋴8 ∪	0.03 0.03	63.0 U	H/A (1)	O
Local 1995 1104 19911 20011 20011 A.2011 2004	SIFFIDELIK	FYFISE	Term In	13! U	147 ;;	315 U	88 S U	63.0 U	750 U	266 U	O 0 09	6300	1 174 (1)	Ġ
מושב וומישת שניים ביים ביים ביים ביים ביים ביים ביים	SMFIDBING	BAM	Tales	127 U	nese	20.9 U	5.80 C	4 20 U	20.05	1.20 J	4 00 C	1.43 J	(1) \(\alpha\)	O

(2) - Expiosities Compounds not Analyzed.

(1) - Nitrated Estica not Analyzod.

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TEST RUN 16 600°F/6 HOURS

HWAAP - Hot Ges Filst Study Fre Test 18 - 600 Dag F, 6 Hrs

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	· · · · · ·	4-15- 8		1,3,6	4			24.6	26	7	early also	1011
MATHUX	HIX UNITS	8 httx	F.O.X	17.3	C	N.S	TETWINE	1995	Dort	بر د. ا	1	
3	1 15/3	127 U	n oct	20000	D 150.38	42001)	D USSESS	18,000	U (X.34	45000	13/2/11	
FISE	E Tail	159 U	123 U	233 U	73.6 U	52.5 U	0:39	2:0 U	50.00	2250	10 4/11	
RASE		₩ 635 U	450 U	1050 U	205 ∪	210 U	2500 U	U 098	25.0 U	21010		
HE TE		A 635 U	450 U	1050 U	285 U	210 U	2500 U	D Cige	2000	210 U	N VIZ	
PULSE		159 U	123 U	263 U	33.8 U	52.5 U	U SS3	240 U	50.00	5250	1	
WIPE		127 0	3.20 J	6.20 J	4.60 J	1880	2000	65.2	4 00 U	30.6	N V	7
WPE		127 U	D 09 G	O 6 02	00.9	4.20 C	0.008	1.30	4 00 U	1.53	NAME OF THE PERSON OF THE PERS	
\$2 \$2 \$2		1910 U	1470 U	3150 J	Bas U	⊃ 059	7500 U	2630 U	7 009	445.1	N/A	
HE ASE	1	19100 U	14/00 U	31500 U	U 026.9	00053	75000 U	163333	U (503.8)	0.0564		2
¥.PE	E Total up	1270	0.09.0	€.10 J	283	180	0000	4.70.4	4 00 0	4.20	N/A	
MPR	E Total 150	33.4	240	17.0 J	3.10 J	10.4	20.03	97	4000	00	1 × 1	
3		1910 U	1470 U	3150 U	685 U	0.30 U	7500 U	2600 U	600 13	1 00		***
SSEC	E Total up	19100 U	14700 U	U 0021E	D OCES	D ODES	75000 U	16:000	60000	6.000		
VAPE	E Total up	12 / D	D 660 U	0.000	200.9	1300	2000	1 0.30	128	- 52 6		20000
WIPE	E Total ug	127 U	0.80 ∪	2080	2003	4.30	0 0 0S	927	188	2 70 6		3 ,
WIPE	E Total up	378	1610	2030	0 0 63	420 U	200 0	11 651	11007	1007	52	2
WPE	E Total up	127 U	⊃ C9:0	30.9.0	D 03.5	1300	0.00%	1 23 1	1007	2 64 4	1	200
WPE	E Total up	(2) Y/W	NA C	NA (Z)	NA (2)	N.A.(2)	NA (2)	MA (2)	N/A (S)	11/A (C)	100	
WIPE	E Total ug) Y/N	NVA (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	M/A (2)	(C) \(\frac{1}{2}\)		3 8	17.7
									7		3	

(1) - Nicated Esture not Analyzed.

(2) - Explosives Compounds not Analyzed.

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HWAAP - Hot Gas Pilot Study Fost Test 18 - 600 Dag F, 6 H/s

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					7 6 7	Ą			2,4,6	2,6	2,4	CHINATED .	TCIAL
But The State of t	La & Tear	11.11YA	H	жое	1.13	7	22	TETHYL	ma	UNT	Did	Ell Care	Exputation
30.00	_	1,51	12.63	UC.30	2000	0.000	0 42 U	5.00 U	1.82 U	0.400	0.420 U	10.40	0
	D. J. G.	Test Services	U est	123 U	Design	73.60	525U	0 S23	240 U	50.0 U	62.5 U	14 (E)	0
3 10 C C C C C C C C C C C C C C C C C C	N N	100	1270	0.630	2000	103.9 103.9	4.20 €	50.0 U	10.0 5	£ 00:₹	1.10.3	N/A (i)	٥
	1	Total	12711	U 08 G	7603	5.90 U	783	20.0	14.8 J	0.00 €	233 J	E YA	0
7 C 20 47 - 27	DINIGE	Tari	25413	108.0	418 U	1180	84.0 U	1000 U	384 U	90.0 U	84.0 U	W/: 13	٥
FO LIVE	Jor no	201	15011	123 U	283	73.8 U	6250	U 253	240 U	0.0S	52.5 U	E XX	0
100	John Co.	57.77	63511	0.087	1030	255 U	210 U	2500 U	N 0005	200 U	210 U	EVA	0
7012	201419	2000	635 (1	0.037	1050	2250	210 U	U 0025	∩ 03 6	200 U	210 U	E VX	0
7017	200		11 #24	11 007	10:01	2650	210 U	100000	D 096	್ದಾರ್	210 U	N/A (1)	0
2017.5			87.8 11	11 037	10501	2550	210 U	2500 U	D OSG	200 U	210 U	(I) Y/Y	0
roi M4	Den L	3	200	1100	11006	200.0	4200	20.08	7.60 J	7.00	2.30 J	(E) Y/N	٥
STATE OF THE PARTY	20110	2	25.4	10.8 11	61813	tieu	94.00) 000 i	3340	90.0 C	84.0 U	(I) Y/N	0
			11 530	1221	2531	1367	U 5 23	U 52.8	240 U	D 0.05	52.5 U	(I) YA	0
SETIDELE	100	3 5	1 300	1100	10501	2550	216 U	2500 U	0.090	200	210 U	E YA	0
THE STATE OF	DITIO	Trans.	635 11	0.84	1050 U	265 J	210 U	2500 U	U 058	200	210 U	N/A (1)	0
S D LOSSO	PLISE	100	835 13	283	00000	205.0	210 U	2500 U	D 098	300 N	210 U	N/A (1)	0
	Divice	51.7.2	635 11	11 037	10501	295 U	210 U	2500 U	2000	288	210 C	€ *	<u> </u>

(2) - Explosives Compounds not Analyzad.

(1) - Mireland Estate not Analyzed.

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HV/AAP - Het Gas Pilot, study Post Yest 16 - 600 Deg. F., 6 Hrs

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Г		7	1	Т	7	٦-	Ţ	T	Ţ	-	7	T	7	7	_	<u> </u>	-	ī		T	ï	7	- [
	1007	0.23			3	-	>				- -	ا ا	اد	0	ပ	0	0	c		3		(V	ત્તું: આ
	07.55.74	1	M/A (1)	100	200	1000			1000		2		11	10 42	MA (·)	(E) Y/2	EVY (3)	11/4 (1)	1 × 1		3 3	313	0.60
	2.4.	2,110	11 5 40	525.11	200	200	11 036				3 3	318			3	420€	4.2. J	3	42011	(0)		1000	3 S
	2,6	בייו	DO:0	50011	1997	2000	= 8	1 800	2	100			319	3	3	J (8) 7	⊃ (g	100.4	100	N/A (2)	1	20 V/14	300
	2,4,4	TELL	D 495	240 (1	2007	11090	11 1190	Sa	1.801	10.01	12.1	-			7	E.20 J	13.2 J	200	10.2 J	N/A (3)	F 7 7 1	(c) V/N	15. V/N
		TETHYL	10:01	U 553	2500 U	2500 U	25001	2500 U	50.013	1058	1005	1000				2002	1000	£0.03	20.00	NA (2)	5	10 V	N.A.
		Na	8400	52.5 U	210 U	21017	2,00	216.0	100	300	11 03 9	700.	12	186		4.50	280	4.20 U	4 20 U	N/A (2) T	14/4 (2)	N/A (3)	S ¥
	4	Deid	118 U	23.60	25.5 U	255 U	285 U	265 U	280	289	9000	700	8 00 13	5		3	280	2 50 U	5 80 U	NA (2)	N/A (2)	WA (2)	NA (2)
	1,0,1	11154	418 1)	200 U	10501	10501	102301	10501	2090	2000	20.00	2008	20.00	= 8		2000	200	2000	20.9 U	N/A (2)	N/A (2)	NA (2)	NA (2)
		E.	U or	123 U	7 034	0.001	7 08.4	J 06.4	D 264	J 08:3	D 03 6	D 08 6	280	0830	1150	3 3	3	3	0.00	NVA (2)	N/A (2)	N/A (2)	NVA (3)
	•		254 C	159 U	635 U	U 550	635 U	0 51.3	1270	127 U	12.7 U		1270	1.				15/21		MA G	N/A (2)	N/A (2)	N/A (2)
		2000	Taling	Teldun	Total up	Total us	Total	Total up	Totales	ומשומו	Totalog	Total up	Totalio	Total un	Total so	3	3	3	ומנון ווס	[מא נוס	Total up	Total ug	Tatalog
		* YUNX	RISE	FLISE	RINSE	RUISE	RUTSE	RUSE	WIPE	WIPE	MOSE	3 diM	JdIM	-	۲	†	†	7	7	7	VAPE	WIPE	N.FE
		TEST ILEM	201 NS	S., FLD. BLPK	SHVRI	SINAS	SIVR3	StVR4	SUFID BUNK	SSH FLD. BLYK	SSR W 1	SSAWZ	SSRWO	SSRWA	SSAWS	Sawa	Coom 3	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	NA HOO	Star Late W2	SUFIDELIN	CHING WALL W2	CHANG WALL BL

(1) - Huustad Estara not Analy sad.

(2) - Explosives Compounds not Analyzed.

TEST RUN 17 600°F/48 HOURS

1311R2

HWAAP - Hot Gas Pilot Study Pre Test 17 - 600 Esu F, 48 Hre

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(1) - Nikulad Estars not Analyzed.

(2) - Explosives Comprounds to thruly ad-

HWAAP - Hot Gas Pilot Study Post Tast 17 - 800 Dag F, 48 Hrs

EQUIPMENT	MATRIX	UNITS	AMMONIUM PICRATE
AP 1 R1	RINSE	Total ug	10000 U
AP 1 R2	RINSE	Total ug	10000 U
A? 1 F3	RINSE	Total ug	10000 U
AP 1 R4	RINSE	Total ug	10000 U
AP FLD BLNK	RINSE	Total ug	10000 U
ICHMB WALL BLK	WIPE	Total ug	10.0 U
CHMB WALL WI	WIPE	Total ug	10.0 U
P8 1 R1	PINSE	Tctal ug	10000 U
PB 1 R2	BENIR	Total ug	10000 U
PB 1 R3	PINSE	Total ug	10000 U
PB 1 R4	RINGE	Total ug	10000 U
PB FLD BLNK	AINSE	Total ug	10000 U
SHR 1 91	RINSE	Total ug	10000 U
SHR 1 R2	FINSE	Tctal ug	10000 U
SHR 1 R3	RINSE	Total ug	10000 U
SHR 1 R4	RINSE	Total ug	10000 U
SHR FUD BLK	RINSE	Total ug	10000 U
SHV 1 R1	RINSE	Total ug	10000 U
SHV 1 P2	RINSE	Total ug	10000 Ü
SHV 1 R3	RINSE	Total ug	10000 U
SHV 1 R4	RINSE	Total ug	10000 U
SHV FLD BLK	RINSE	Total ug	10000 U
SP FLD BLNK	HINSE	Total ug	10000 U
SP R1	RINSE	Total ug	10000 U
SP R2	RINSE	Total ug	10000 U
SP R3	RINSE	Total ug	10000 U
SP R4	RINSE	Tctal ug	10000 U

TEST RUN 13 500°F/6 HOURS

1311R2

HWAAP - Het Gas Pilot Study Pro Toat 18 - 500 Dag F, 6 filo

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	7.00	2	BAN'L CARAGE	0		c	0		=	9	9	0544	0000	0			0101	2	170	1650	3000	65.7	0	11/4 (2)	70, 0, 1
	12 9 K T W 1 W 1		f. ib s in road	E/Y (3)	SAN	11/4 /11	A.A.		7	11 11	2/2	NA E	N/A (S)	11/A (5)	11/4	717 5717		7	11 4/11	C 432	N/A (1)	WA (1)	N. A. (1)	27.5	
	2.4.		Š	4263 0	42.0 U	115.63	11 5 25	21011		2017		4200	4.500 U	4.20 U	1027	2.3	1000	4 20 11	1200	26.00	3	4201	0.85	17.6 (3)	1 2 2 1
	25.		دُدُ	46.50 C	4000	20.00	50 OU	11 026	10.6		3	40.00	1000 1	⊃ 88 •	100.4	2001	1 00	4 20 11	11007		20.00	C 03.4	7 80 T	11/1/23	11/4 (2)
	2,4,6	7.0		D (X)	G	11 (3. 1	300	11000	11 0%	10.01	200	0 26	4823	19.2 ()	19.2 U	1500	19211	216	11 681	93,6		. C.	30.5 J	M/A (2)	N/A (2)
		18.75.16		SAN S	200	625 U	825 U	D 0072	2500 C	55011	11 003		DOXXXX	50.0 U	0000	D 052	10073	2003	2030	250 11	11000	20.00	0003	N/A (2)	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
		116	٢	7	420 U	525U	525U	210 U	210 U	21.111	11007		200	3	4.30 U	21.0 U	6.70	1.60 J	4200	21.0 U	7 20	+	1.50 0	C Y	(i) 1:X
	4	100	1500	2	26.00	73.8 U	73.8 U	205 U	205 U	5.80 U	88011	11 00 00		0.650	2000	2050	5.S.C	S.80 U	0003	20.50	100 %	100	200	200	5 VA
	1,3,6-	25.5	200703	3	0.00	200	2830	1650	10501	200	∩ @&	10000		200	On a	105.0	20.3 U	20.90	20.90	1050	26.0%	11000	13/4 (S)	10 VIV	151 1/21
		Xas	11 0223	1000		0.55	123.0	73	0.034	D 630 U	80.0 1	23350	11 00 0	313	3	4930	14.2) 33.0	1830	49.00	3.60 4	586	50 4/12	2 3 3	1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
	;	HALK	127CO U	23.65		3	0.00			12.7 U	4130	_	T=	, =	15.70		2.10 J	491		ននិប	12.7 U	1270	N/A (2)		•
	-	8177	2/5/1	1,5	1	3	51	3	102 03	SEE	Total up	Talua	Tutalisa	1000	5	3	00 700	Da Elo	00 80	Total up	Tall	Total un	Total to	Total	
	7000	MAINIA	300	Ş	35130	201760	100	2	2000	MIN	W. JE	WEE	Wire	13.53	1	1	Т	MILLE	WE	Tr. SE	WAPE	∃d'M	WIPE	1	1
	6.12000 W. 5.40W	201112	C. A.Y Parie	C. AY FINE	CPEDRING	70 10 10 10 10 10 10 10 10 10 10 10 10 10	4 50	200	707	N. P. L. P.	びととなった	世紀上の	SM FLD Strik	SSAFIOREN	2 2 3 C 2 C C C	2 10 10 10 10 10 10 10 10 10 10 10 10 10	2000	0000 100 0000	O'S CALLED	COLK CLECT	SSR2 WI W4	SOLC WAWA	SH.P FAILE WZ	SE. FLD BLNK	

(1) - Narcadd Estava not Analyzed.

(2) - Explosives Compounds not Analyzed.

HWAAP - Hot Gas Filot Study Post Taul 18 - Ewi Day F, 6 Has

		-	_	-		7	_	_	1	-	Ţ	-	- -	_	- -	<u> </u>	
Tallal			,	0	,	0	=	0			,	0	٥				2
La Támbra	Ar all	(I) V/14		(E) V/(E)	SAN	E WH	NA CE	E V/N	75 7/12		S	342	1.A (1)	113 (2)	5 7.3	3 %	15
2.4	Estr	4 20 11	6 20 11	0.620	1050	1050	150	105 U	105 11	153.0	200	10:01	1650	165 U	165 U	165.11	7.02.4
2.6	DWD	1004	100.4	0.400	282	190	1001	100	100	1000	4 S C	1000	282	1000	100 U	10001	100 t
24.6	TMT	19.2 U	1920	1.82 ∪	7 037	1 08 1	480 U	J 084	100P	2004	1920	U 064	160 U	450 U	U C84	U 00.4	19.2 U
	TETHYL	0003	5000	2002	807	1250 U	1250 U	1250 U	1250 U	1250 U	0.003	1250 U	1250 U	1250 U	12501	12530	5000
	87	4500	1380	0.420 U	105 U	105 U	105 U	105 U	10501	2050	4.20 U	105 U	105 U	16511	10% U	195 C	4.20 U
4	Pica	33	SPOU	0.520 U	148 U	148 U	1.90	148 U	148 U	148 U	6 20 U	148 U	143 U	1/8 U	148 U	148 U	25.0
1,3,6	T) ed	26.9 ∪	2090	2030	523 U	S23 U	0 623	0 523	U 523	623 U	20.6 U	: ::	523 U	ಕಿದ್ದಾರ	ຕະວ	523 U	3.61
	RDX	003	0.55.0	ن دينو و	245 U	245 U	245 U	245 U	245 U	245 U	0.60 U	245 U	245 U	245 ()	245 U	245 U	0.03.6
	HIJK	.270	1270	1.27 U	318 U	318 U	318 U	318 U	318 U	31 8 U	12.7.0	210 C	318 (318 C	313 U	316 U	12.7 U
	Unays	Talus	Taulug	o/cn	Tatalug	Totalun	עה ∽סב	Tala ug	Tasluo	Totalun	Total to	Total	Totalug	िवंज एव	Total ug	Totalog	Tetal top
	MATRIX	Vivile	14 NP EE	3	HALSE.	76.45E	PUISE	_;	RIBE	FWISE	WPE	PANSE	PYISE	RUSE	PIPISE	RINSE	WIPE
	TEST INEM	CPLAID WALL BL	CHASS WALL WI	CLAYPIFE	CLAYPIVE BL	PB 1 R1	P3 1 R2	P3 1 R3	PB 1 R4	PBFIDBIK	Stap Male Wi	SHR I RI	SHI FE	28183	1010	SHAFIDELIK	SAFDRILK

(I) - Discard Estars nut Analyzed.

(2) - Extitudires Compounds not Analyzed

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HWAAP - Hot Gee Pilot Study Foel Your 18 - Du Dug F, 6 Hrs

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	****										-		
	Applicate				1,3,6-	4.			4.5	9	4	() ()	
MATHER UNITS HMX ROX	HWX	-	XCX.		5.4	200	, a	1.4.2.4.4	Trit				7
_	1270	0.4	3	5	3 00	1 3 6	13 (7)	11010	100	100		500	Section of the second
WPE 1314 to 127 U 9 80 U	12.7 U	7.0	3	5	nest:	2.6.11	2 8 7		217	0.00	0	111	3
L	12.7 U	7.0	3	5	0.000	13	2 2 2		700	3	0 07.7		5
L	12.7.0	7.0	3.80		20.03	5 00 U	33	2003	3 3 3	33.5	313	E K	a
TOWN 102 127 U	12.7 U	7.0	039	ī	0.00	5930	11 05 7	1000	0 200	3	0 000	E	o
VAPE TOLALUS 127 U \$ 80 U	12.7 U	30	0.08.8	•	20.50	11 69 6	1100	2003	0 200	7.50	0	10 4/1	0
10%	1270	10%	030	-	20.9 U	1 28.5	1 52 1	1000	2 2 2	3 6	0 2 3	17/7 (1)	0
Total un 12	12.7.0	7.0	0038	****	20.5 U	5 80 1.	28.5		2 2 2	200	1200	(i) V/?	0
Ļ	12.70	12	0000		2000	188	17 00 7			2	002	13 AV	2
L	NA RU	123	NA ES		NA (3)	N/A (2)	100	200	078	3	4.20 0	E VA	0
N/A (2)	NA (2)	A (2)	NA CO		N/A (S)	K. 4/14	100 0110	2 47	12 VA	SE 48	20 4	5.00 U	N/4 (2)
N/A 12	N/A 12	L	NA ES		N'A (3)	S VIN	37.5	10 Km	20 47	N/A (Z)	N.V.	5000	14.4
L	N/S (S)	2	N/A (2)	-	N/A re	E VIN	137 4.13	2 52	NA G	N/A (2)	16.A (2)	5 SO U	N/A (2)
L	2001	130	17011	†	37011	1	1	13:55	151 AV	MAG	15 Y/N	23.5	NVA (?)
		İ			200	3	2 2	200	075	1104	102	107 911.	-

(1) - Hazalad Estara not Analyzad.

(2) - Explosives Confessors not Analyzed.

APPENDIX I EXAMPLE CALCULATIONS

1311R2

Appendix I contains the following calculations:

- * Calculations to determine time for slab to reach temperature.
- Heat balance calculations for Test Russ T2, T3, and T5.

CALCULATIONS TO DETERMINE TIME FOR SLAB TO REACH TEMPERATURE

1311R2

SHEET	- 1	M	9

CLIENT/SUBJECT		W.O. NO
TASK DESCRIPTION TIME FOR SIA	b To Reach Temperature	TASK NO
PREPARED BY NPS DEP		
MATH CHECK BY DEP	1	
METHOD REV. 3Y DEP	i i	

The Following Calculations have been prepared To determine de time required for items to reach target temperature.

Assumptions:

- 1) Pectangular slab will be evaluated
- 2) Lingto = 1 FT
- 3) Height = 1 FT
- 4) MATHIN DE CONSTINTION STEEL

Calculations will be Prepared For 4 Separate Cases:

- . 500 16 slab
- · 1000 16 51AL
- . /500 IL SIAN
- . Slab that is as large as Permissable in Chamber (6 FT H x 20 Ft L x 6 FT &

Unstendy-state conditions exist. Slab will be placed at Front OF Chamber (near door) in vicinity OF Air discharge duct (i.e. worst case - lowest air temperatures).

The hear transfer coefficient for the system was calculated to be 1.44 Bill he fit of (see wolkshut - insulation calculations for flash chamber).

DATA:

RSTUI = 25.9 BRUING FT2 (OF/FT) D 212°F (Bennett; Noyers, 2nd Ed, Parx 778)

CFSTU! = 0.12 BRUIN OF (Bennett; Noyers, 2nd Ed, Parx 793)

CSTUI = 489 15/FT3 (Bennett; Noyers, 2nd ld, Parx 773)

CLENT/SUBJECT	 			ON.C.W	•
				OF XELT	
	 			YE GEVORESA	-
YE KOBHO HTAK	 	DEPT_	 DATE		_
METHOD REV. BY	 	DEPT	 DATE	_ DEPT DATE	_

To estimate time Du "Chait For determining Du tomperature history of Paints at Du centers of rectangular shapes" was utilized (Process Heat Timeser, Kun F. 650). A coay of Du Chait is shown on Figure 18-11.

In chart, $Y = \frac{T_5 - t_{12}}{T_5 - t_3}$

where To = temporative of currounding (air)

the = temporative of the center plane
to = initial temporative

in this Application:

Ts. 550°F (during fair-up) +12: 500°F to = 70°F

In chair, $x = \frac{hL}{2}$

Where he hear transfer cut = = cont L = Principal doom

R = thermal conductivity

For illustration, 4 masses OF Stal at Evaluated.

Where the height of slab (1 FT in Cases 1,2,3; 6 Ft in case 4)

DEN 10.04.00714.518

CLIENT/SUBJECT _				- W.O. NO
TASK DESCRIPTION	Time For	Slab to	Reach Temperature	NO. NO TASK NO
PREPARED 3Y	102	DEPT_19	DATE	APPROVED BY
MATH CHECK BY		DEPT	DATE	
METHOD REV. 3Y		DEPT	DATE	DEPT DATE

muresie,

$$X = \frac{h}{2} \frac{L}{2}$$

$$= \frac{h}{2} \frac{m}$$

Case 1 m=500 1b

	44		1.
25125	P 7	~4	

CLIENT/SUBJECT			
TASK DESCRIPTION TIME	For 5140	to Peach Tempers+	U.O. NO
		1811 DATE	
MATHOD REV. 3Y	DEPT	DATE	DEPT DATE

A+ x = 0.028 and Y = 0.10 but is no culve.

Extrapolating (For 1=0.023)

Conver
$$0.04. - 0.05\% = 0.046 - 0.028$$

Cuive = 61

0 = 0.074 hs (4.4 min)

(As 2 m = 1000 16

Y = 0.10 .

X = 0.057

AT X = 0.057 and 4 = 0.10

Cuive = 42

95W 10.04.0774.578

CLIENT/SUBJECT		W.G. NO.							
TASK DESCRIPTION	Time	F₀(SIAb	45	Reach	Timpera	214	TAGK NO.	
								APPROVED BY	ضا حصيمانينې ا
METHOD SEV 34			.E9T		DAT			EPT DATE	

0 = 0.20 hr (12 minutes)

(Ase 3 m = 1500 16

1 = 0. 10

X = 0.085

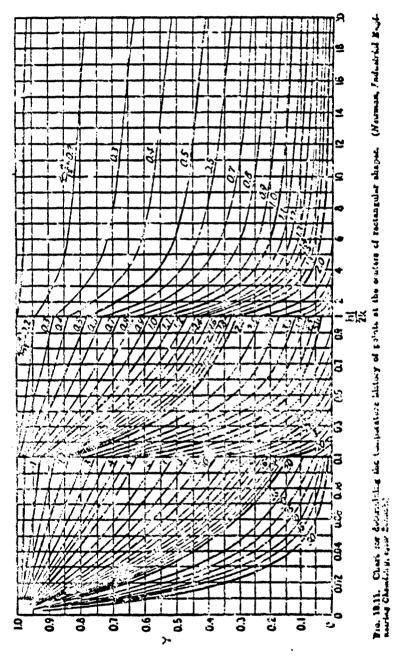
8 = 0.43 hr (26 min)

X = 0.17At Y= 0.10 and X = 0.17, Culve = 20 = 4 | 25.4 | 470 = 4 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16° = 1 | 16

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PROCESC HEAT TPANSFER



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ELAT BALANCE CALCULATIONS TEST RUNS 2, 3, & 5

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SUBJECT USA	15+ Run #2	Heat Calance	TAS	7600-0 X NO2
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	- Vendon Grap	5 PSU 1.875	(cf) = 75.	5
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EXPENSIVE TO THE PLANE # 2 Hart & slave # TIXNO 2 EMARED BY 17 COSTOS DEPT 18/1 DATT / FF 590 A RC+ED BY THEOREX BY DEPT DATE THEOREX BY DEPT DATE [105 blane) (.01 5 th 6/ham.) 7 1.05 blane [105 blane) (.01 5 th 6/ham.) 7 1.05 blane [119.40 blane - [151 blane) - 1.05 blane - 1.05 blane [119.40 blane - [151 blane) - 1.05 blane - 1.05 blane [119.40 blane - [151 blane) - 1.05 blane [12 basis [2 2.99 lb / 15 [3 2.07 blane [4 2.07 blane [5 2.99 blane) - 1.05 blane [6 2.99 blane) - 1.05 blane [6 2.99 blane) - 1.05 blane [7 2.99 blane) - 1.05 blane [8 2.99 blane) - 1.05 blane [9 2.90 blane) - 1.05 blane [9	TOTUSUSCECT USA	TH 2004			2000-00.3
EMARED SY 17 Cosmos DEPT 1811 DATE 1569 A TOSED SY THOCHECK 3Y DEPT DATE DATE [MASSING WATER LUAD] (105 15/mm) (.01 5 Mg/ham) = 1.05 15/mm [Mass Balance Check [19.40 15/mm] - [151 1/m + 105 1/mm] - 1.05 15/mm [17.4 1/mm] [2.37 15/mm] [2.39 15/15 [3.07 15/15			ent Galance		
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CO2 2.99 15/15 H20 1.63 15/15 No 12.07 15/15 Total 16.69 15/15 - 15,67 15/15 comb and Com bus From of Fuel CO2 (15) 15/100 (2.99 15/15) - 15.57 15/10 H20 (1.51 16/1000)(1.63 15/15) + (1.05 7/100) = 3.51 15/10 No (1.51 15/1000)(12.07 15/15) = 18.23 15/10 Excess Ain = 10/15 Ain = 00 on bustone Am (105 15/1000) - (151 15/1000)(15.69 15/16) = 81.31 15/1000	Com	Surt on & P	hoane Ill ha	C/(
H20 1.63 15/15 No 12.07 15/15 Total 16.69 15/15 - 15/15 - 15,67 5/15 comb 4m Com bus From of Fuel PO2 (1.5) 15/mm) (2.99 5/15) - 41.37 15/mm H20 (1.51 16/mm) (1.63 15/15) + (1.05 1/mm) = 3.51 15/mm No (1.51 15/mm) (12.07 15/15) - 18.23 15/mm Excess Am = 10/2 + Am = combustone Am (105 15/mm) - (1.51 15/mm) (15.69 4/16) = 81.31 15/mm					•
H20 1.63 15/15 No 12.07 15/15 Total 16.69 15/15 - 15/15 - 15,67 5/15 comb 4m Com bus From of Fuel PO2 (1.5) 15/mm) (2.99 5/15) - 41.37 15/mm H20 (1.51 16/mm) (1.63 15/15) + (1.05 1/mm) = 3.51 15/mm No (1.51 15/mm) (12.07 15/15) - 18.23 15/mm Excess Am = 10/2 + Am = combustone Am (105 15/mm) - (1.51 15/mm) (15.69 4/16) = 81.31 15/mm		(0. 299	14. 115		
No. 12.07 16/16 Total 110.69 16/16 - 1 15/15 - 15.67 16/16 comb for Com Boston of Fuel Coz (1.5) 16/min) (2.99 16/16) - 4.57 16/min HLO (1.51 16/min) (1.63 16/16) + (1.05 1/min) = 3.51 16/min No. (1.51 16/min) (12.07 16/16) - 18.23 16/min Excess Am = 1 10/0 th para - combutour Am (105 16/min) - (1.51 16/min) (15/109 16/16) = 81.31 15/min	a company to a company of the compan			desplay or a support, were as an under	مين <u>مين ما دو در دين</u> در در دين دو در دين دو دو دو دو دو دو دو دو دو دو دو دو دو
Total 110.69 15/16 - 115/15 - 15.67 15/15 com 5 4m Com bus two of Fuel Com (1.5) 15/mm (2.99 15/15) - 11.57 15/m H.O (1.51 15/mm) (1.63 15/15) + (1.65 1/mm) = 3.51 15/m NL (1.51 15/mm) (12.07 15/15) - 18.23 15/m Excess Am = 1 w/s + Am - com bustom Am (105 15/mm) - (1.51 15/mm) (15.69 15/16) = 81.31 15/mm					
Com bus trum of Fuel Coz (1.5) 15/mm) (2.99 15/15) - 41.3-1 15/mm Had (1.51 16/mm) (1.63 15/15) + (1.05 4/mm) = 3.51 15/mm Ne (1.51 15/mm) (12.07 15/15) - 18.23 15/mm Excess Am = 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					•
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[(105 b/min) - (151 b/min) (15,69 b/b) = 81.31 b/min		1. 313 1.000 91_	7.047	The second states of the secon	ميس مست و دو مستد د
[(105 b/min) - (151 b/min) (15,69 b/b) = 81.31 b/min	the second secon	00- (15)	1/204 1/16		45/
[(105 b/min) - (151 b/min) (15,69 b/b) = 81.31 b/min	er ger i i i i i in bilimera merimera e	1102 (1.5)	1/11/2 / (117/5/5) +	1 1004	3 = 3 = 75/
Excess Am = INIE + Am - combutum Am (105 8/min) - (151 5/mm)(15,69 4/6) = 81.31 3/min	ه سپ ، مجمعه مستعد ه مشخص	المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب المراكب	(1) (12 03 (1/4)	C J. CLS 1/4	2 2 2 14
(105 B/min) - (1.51 B/min) (15,169 4/16) = 81.31 B/min	ina i sa sa apaman na na apaman na apaman sa apaman na			 .	المعامل المنظورة إلى المسالات
(105 B/min) - (1.51 B/min) (15,169 4/16) = 81.31 B/min			17		بدينت فالمهيورة والمحادث والمحاورة والمحاورة والمحاورة والمحادث وا
,	<i></i>	ess_Hin!	JIE AIR CUM S	بمدائر سامدان	
,	The same of the sa	(1000)	(15.15/ 15/	3/1/2	C/ 3/3/
02 = (81.31 5/m) (0.2120) - 17.07 15/m	nincianis, aprilima a printinga a printinga a respectiva and a security and a sec	(103 /417)-	1-1 /Mm)(15/0)	1/0)	81. 31 /414
Uz = (81, 31 /m) (0, 21 / 02) - 1 / 02 / mi	particular and the control of the co		1.8/. 1/200		76/
		<u></u>	1 101 1 1 1 1 1 1 1 1 1 1	<u> </u>	1,01 / 100
		والمراجعة والمتالية والمتالية والتنو والمتا		!	



LENT/OURLAST 12/2/E	743753		<i>'il.o.</i> No	7000-00-24
	+ Ruy + 2 Heat			ASK XO 2
	1801 SEPT 1811		5 93	APPROVED BY
	DEPT DEPT		ZEPT	DATE
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	·		-	
Heat	Released by	Fuel		
•	(1,51 6/2,2) (19			30, 115 BT4/mi
r de l'unit repaire de l'une des de l'action de l'acti	(1,31 1,00) (11)	777 - 753	. -	<u> </u>
Heat	+ Absurbed by	Combustion	Products	
				375
60.	(4.5, 15/mix)(0,225 "1/15	of)(812-70	为= 753元
H ₂ O	(3,51 /min)(0	478 154/135	812-70 (=)	1244
	(18.23 "/min)	0,25 0 /4°F)	级-70万)	= 3,382
. <u> </u>	+ Absorbed	· · · · · · · · · · · · · · · · · · ·		
// CA	47		يم د د. شد سد. ، سميد	e e e e como e especial e e e e e e e e e e e e e e e e e e e
- apprint print of the second	(8/31 15/mm)	(024 54/15·F)	(812-70F)	= 14 480 =
2	The state of the s	e Transport to the property of the transport of the second		19, 852
MAL	liation Losse _	and the same of th	appagas minima a para sa a sa a sa a sa a sa a sa a s	
<u> </u>	urare ANA	angga palifiki kan ngu masak kalumatan ngu te amu mate sila na paba	in adaman ampinetti one representationi	
		Managaran da	entralista i de la desta de la constitución de la c	
markaning and an analysis of the second seco	Tr (20, meh) ("	reach) (6,5ft	12454) =	162. H
•	(162 ATY 2.8°	My Alie Van	0.15-20.1E)(17420
unterna unida iar a ar majagajan hanapatahinar sari sudaka s				, , , , , , , , , , , , , , , , , , ,
Hex	+ BALANCE	Compasilson_	in dige and in con- amountain the equilibrium is a	
	Pare		Dr.	W// 2 5
and the same of th	(30,115 BTU/MIN			2237
	market assess a reference and the second second second second second second second second second second second	30, 115 250)		
A STATE OF THE PARTY OF THE PAR			1	
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		<u> </u>	<u> </u>	

MOTEN.

••	Sept.	Marie Carrier 19		<u> </u>
CLENT/SUBJECT				20-00-24
	Tet Pun + 2			
PREPARED BY 💯 .	COLMON CEPT / 51/	DATE 16 FOLFS	APPROV	/ED JY
METHOD REV. 3Y	DEPT	DATE	_ SEPT	DAYE
	391 3917 1.13 9 15,97 7 81.25 7 2.37 2 Or (2067 dscfm Vr (2067 dscfm	Destan I 57, P I 37 F WARCAM 1 CO. 7 Or 1 N2 1 H20)(0,01/3)(0.1137)(0.1597)(0.082)(0.8125)(0.0729	is 15/scf)= 2	7,30 15/11.
	420 X	= - 0187		
	X 7 (61.08 dm) (.040		
	CARAge Estimate			
		- 119, 40 16/min = 2	22,672	
	Leadage Volume			
	(154,39 3/2	- 119, 40 13/an	.) - 34.99	N/Ann

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T/3URJECT(/S/	ATHÀMA		· 	e <u>े एक २००० वा</u>	
DESCRIPTION TE	st Rin 甘文	Heat Bala	ج الم	TASK NO 2	
	MOS DEPT 181			APPROVED 3Y	
	DEPT				
OD REV. 3Y	DEPT	DATE	EFT	DATE	
Hent Co Hz	O (2.41+2.54)	(0.478 aru/160)	F)(812-39 F)(812-39 0.25)(812-39	91°F)= 278' 1°F)= 528	<u>37</u>
	Total Heat	Lost by	Het Gas	12,599	
Н	(34 90 15)	•		6°F) • 2,696	
He	at Lost The	ر المعلق المعالم المعا	a completele and a series construction of the series of th		
	(12,599	(mm) - (26!	9c 5m/mm)	9 903 BM	lin
	Marie Annual Control of the Control	digen ya asashiidigen ya -uu-uus dien dagan maagigatida	m marketining ellergiste and 1-3/6 expendents - 4/	agenedigin — on antitionary site one attended the state of the state o	
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LENT/SUBJECT USAT	и.э. но	4.3. NO. 7000 - DC - 24				
SK DESCRIPTION Tost PIN #2 Hest Galance			TAX	TACK NO.		
REPARED BY M. Cusmos	_ DEPT_1311	CATE	- Ac	PROVED 3Y		
ATH CHECK 3Y	೨೦೯۲	DATE				
ETHOD REV. 3Y	cept	DATE	DEPT	DATE		
Auer.43 e	Fuel GA.	s Pressure	_ 6.34 psig	and the control of th		
Average	TO Ex	t Gas				
	24/7	Oschm + 5.5	. n			
Math of Theory and the Landson of the Control of th	17/3	,		ente ett en : - ettingggerije, seder m n en een een en		
	12 500	•		a de la principa de la compansión de la		
	6.5					
and the second s		2 02				
angles on so one o anaguaga- one on apaggipping atomic analysis of motor an apaggipping				and the second s		
resignation of material analysis and the control and the contr	- 6 8 -	2 H2O	<u> </u>	٠ ــ ــ ــ .		
2/3		V -7-705	15/1	C) = (5 0 15)		
	(2467 deten	(065 606)(.1/378/A)	(d) = 18.2_1		
<u> </u>	(2467 dector	V 107 02	(077.25 W	:N= 21 8 %		
-	1 2 10 - 22 20 11	·JC_7 <u></u>				
N2	(2467 Ascf	J/ . 825 N2)	1.07240 13	(ct) = 147 9		
HO	X	086		and the second of the second s		
	2147 + X					
andragy Madridge	\\	232 mm)(.	2000	= /7.80		
	X = (232 mm/C	0407 /11)			
				198.7%		
	1					
GAS	Flow					
	<u> </u>					
	nach = (1.10	ر بعد 48.9) (22)			
		Δ				
	- 2.9	7 near = 45	mm Brul	5.00 1 1 1		
		72.3	. 1			
	1	:				



	3655 S 3 / 5
CLENT/SUBJECT <u>USATHAMA</u> TAS DESCRIPTION Test RUN # 2 Heat Bala	W.O. NO. 7000 - 00 - 24
PREPARED BY M. COLMUS DEPT 1811 DATE	TASK NO
MATH CHECK BY DEPT DATE DATE	APPHOVED ST
DEPT DATE	DEPT DATE
(4 500 000 BTU/h) / 2316 BT	1/scf = 1943 scfh 32.4 scfm
(32.4 s.fm)(0.1196 12/s.f)	= 3.87 13/min
AIR Leshage	
198.7 15/min - (154.4 15/min +	2.87 15/mm) = 40.4 15/mm 20.32
Comboustion Product	The second control of the second control of
CO2 (3.87 15/mm) (2.99 15/15) =	11,57 15/100
H2O (3.87 B/M) (1.63 B/16) =	6.31 13/20
Nz (3.87 15/m) (12.07 15/15) =	46.71 15/mi
An Consumed (3.87'5/mm)(15,69 3/16) = 60.72 3/mi
Mass Balauce Check	entransportura en acceptante en entransportura. Entra especial entransportura de una entransportura de una esc Referenta en entransportura especial provincia en entransportura en en entransportura de entranspor
CO2 18,2 15/m, - (11.57 15/m).	· + 2.94 //ww
H20 10,30 15/m, - (631 15/m	The state of the s
N2 1479 1/20 - (421.5	$9 + 29 (90.4 \%_{10}) = -3.82$
142.	69 16 James

362<u>3 9 4 /0</u>

ENT/SUBJECT USAT		U. + R.I		7000-00-2
ASK DESCRIPTION Tes REPARED BY M. Cosm				PROVED JY
REPARED BY <u>7 1/2 303//</u> MATH CHECK BY		DATE	A1"	7207ED 31
AETHOD REV. 3Y			SEPT	DATE
- April control of the second		-		
	/ a 151	- 13/	/. 15/	1 (10.35)
<u> </u>	$(21.3^{17}/m_{12})$	- (27.33 13/m, 14		.) - 51(60.75
		21.513/2	· • •	
				-5.66?
· · · · · · · · · · · · · · · · · · ·			- · · · · · · · · · · ·	
ites 1	Balance Che	ch		
		- 1		
HEAT	hleased by	ruel		
	2034/ . \/	19, 944 874/15)		- BTU/ .
	3,87 -/min)(1), 144 //5)	- 11,18	5 /////
11 . *	01 44-1-0	By F.C. Ex.	t Gara	
HC	HOZUKBEU	by 1. C. Cx,	נאנרט	
CO	(294 1/2))(,0225 314/15.1	= \(1710 = 391 1	*) = 878 ==
	(3. (1. //mia	76,0223 757) 0 // C ·//
1+2 O	(2.62 15/20) (478 BT4/10F)	(1718-391°F) = 1662 an
N ₂	(121.59 5/	···) (.25 3 Tu/15 "F	=) (1718-3910	=) = 40337 4
O ₁	(27.30 - 21	((a.72)) (,23 am	/15.E) (1718-35	(=) = 4,247 =
·	w. a.f. r			
	a mana arang menganakan dan dan dan	production of the second		46 334 0
and a despendent to the comment of the second			ما تاكني <mark>ت مس</mark> وات	
Iteat	- Assumbed by	y Combation P.	ineliets	
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	c (11,5)"/m	~)(0,225°TH/15°F	J(1718-39, F	J = 3755 =
		574/		-\ _ ar
He C	(9.31, 1/m	1. 21/12 8 8 1. O. YOU	7)(1718-39)7	7002
t managanisma distribution del managanisma antica destributo de com- l	- and common or industry and common a complete and the common or	· · · · · · · · · · · · · · · · · · ·		7457
to be the company of				7737
<i>U</i>	+ ASma Lan	by Leak to		
// CA	י אש כ אטנייון	- CAR _ 21	//\	
· An	(70.4 3/2.) (0.24 50/16 of	1/1767 - 70 1	= 16148
			and the half of a second his fact.	

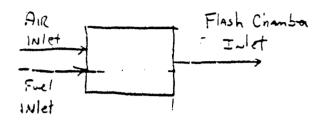
3



NT/SUBJECT	USATHAMA				
				'W.O. N	0 7000 - 00 -
(DESCRIPTION_	Test Run #	2 Heat	BA lance		TACK NO
PARES BY _/??	Cosmis DEPT	1811 DA	1247FS 9	70	APPROVED JY
Y6 X32KD K1		DA'			
THOD REV. 3Y	DEPT	DA	72	DEPT _	DATE
7 2	liation Losses				and the second s
•	Sunface An		• ••• ·		
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		. 	. 	<u> </u>	
	Heat Loss				
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The second of th	101 W C 2 CCO-4	and the second s			
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section a nation of an analysis and	(6, 33 4 cm/m	14 4, 1427	10,6	43 /mm+	יאה טרנב
umove overse en escribio en el se el applicação	d minus varians valennasja gelejija vajdojim v viva – viva – viva – vivas – videlija ja j	a velationa agusta - a salat matellatifona matellitament der 1900 190		an indistruption or or or or	in statement workform with a second confidence of the second confidence of the second
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CHEET	 J.	11
	 -	-

CLENT/SUBJECT USATHAMA		ж.э. но <u>7000 - 00 - 24</u>
TANK DESCRIPTION Tet Res #3 Host	RalANCE	CN XSAT
PREPARED BY M.COS/765 DEPT 1811	DATE 20 5 79	YE dayorask
MATH CHECK BY DEPT	DATE	
METHOD REV. SY DEPT	DATE	DEPT DATE



Average Inlet Am flow PIZOZ 1.11 ming #

Average Fuel Gas. Pressure PI310 2,8/ps/ =

Average Flash Chamber Inlet measured data

1633 dscfm ± 7%

1031 °F (959°F on process theresouple

5533 wasfm

2.1 2 CO2 by Volume d. Sazi

1.3 % 02 by Volume cs, 5asis

31.5 % by Volume & Casis

3.2 % 1/20 by Volume

 $CO_{L}(1633 dschm)(.021 CO2)(:1/378 1/26) = 3.90 15/mm$ $O_{L}(1633 dschm)(.163 O2)(.08275 1/26) = 22.03 15/mm$ $N_{L}(1633 dschm)(.815 N_{L})(.072 1/26) = 96.36 15/mm$

x = (53,98 cfm)(.04654 /21) = 2.51 15/m/m

124,80 15/min_

AFW 10-05-003/A-5/85

CLANT/SUBJECTUSATH	ym a	W.O. NO 7000 -00-24	
			7A3K NO
PREPARED BY M.C. 10055	CEPT	DATE 205-089	YE GEVOREGAL
MATH CHECK BY	DEPT		
METHOD REV. BY	DEPT		DEPT DATE

Concection to gas flows for Alt tode

cone = e (.0000360286 (4500ff)) = 1.176

designs / scotion = e (.0000360286 (17070ff)) = 1.066

Density ratios = 1.176 / 1.066 = 1.103

Pouph = (900/95000) (Pint)

= 1.103 (2.81psis)

= 3.10 psig

From vendor graph 802 3.10psig = 2.15 mm stu/fin

2,150,000 et/h / (2316 stu/stp) =

928 scfh = 15.47 scfm propane

(15.475ch) (0.1196156) = 1.85 lb/mm

Combustion Airflow by connelation curve

Flow = 1433 +- 406 (ln(1.11mg)) = 1475sa

(1450scfm)(.075 B/scf) = 108,7 15/m_

Moiston lunding under worst absenced

Conditions 60°F = .01 15 400/15 dA

7FW 10-03-003/A-5/65

LENT/SUBJECT	THAMA		. אין אין	34 21 3 x 1/
NOITHIRDESU XEA				K NO
REPARED BY ATH CHECK BY				PROVED 3Y
ETHOD REV. 3Y			DEPT	DATE
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MAX	imum wria	land.		
	(100 7 3/	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(da) = 1.1 15/	,
-	(108,7 7)		(dA)= 1./ /5/	na Hi O
<i>C</i> 2	0 1	- 1		•
Mas	S CALANCE (Check ou	t-12 /out =	
	124 80 13/20	-(1.85 54. + 1	08.7 A = + 1.1 H24)	
		124.8 15/min	06.7 A12 + 1.7 H24)	>
		, F-67	, , , , , ,	
		/0.5% c	lasure within	
				na es
Com 5	ustron of Prop	pane one 15	bases	
	CO2 2,9	19 B/16		
	140 1.6			
	N2 12.0	7 15/15		
	70tal 16.6	9 15/15 - 18/18	- 15 19 4/1	
<i>a</i> ,			7-,6, 713	
(omb.	is them it . F	Se/		
C	02 . (1.85)(.	2.99 15/15) = .	553 16/	
$\mathcal{H}_{\!$	U * (1.85)(1	1.63 13/13/3	3 22 + 11 =	4.12 B/am
N	(i, 85) (i.	ع (دارد ده. د	2, 33	,
Excess	An			
				man manua () de l'andres (despe
	100 7 71	1	/ 11a	15/
	108.) /m, = ((1.85 7 m, 1 15.67	16.73 18/min	51 1 min

mling / Chaise / L	USATHAMA		94.0. NO 7000 - 00-24
YASK DESCRIPTION.	Test Run +3 -	Heat Caloner	TASK KO
Preparied by 💯	COLDEN DEPT 1811	DATS 2120 69	YE GAVORGER
MATH CHECK B /			
METHOD AEV. BY 📖		OATE	DEFT DATE

Heat BAIANIE

Radiation Losses

Sufface Area

$$T(201nch)(\frac{14}{R})(6.5H + 24.5H) - 162H^{2}$$

$$(162H^{2})(23^{34}laFH)(300F - 70F)(\frac{1}{200m}) \cdot 1,742 BT4/m$$
Heat Balance Companison
$$\frac{(36.896^{374/min}) - (26829 + 1742)}{36.896^{374/min}} = 22.6\%$$

CLIENT/SUBJECT ALS AT				7000-00-24
TASK DESCRIPTIONText	trun #3 /	at Calance	TA:	K NO
PRETARED BY M Co.	201 DEPT_ 18//	LATE 21 Sto 8	Z No.	PROVED JY
WATH CHECK BYYE XOBRO RTAW				
METHOD REV. BY		DATE	-1337	2473
	452 3160 1,26 17,43 81,30 3.83	dscfm ± 370 F ± 370 Wasfrn 7 COL by VIII 2 OZ by VIII 2 No by VIII 2 HIO by VIII) 	
. (0	(1833 declin) (0.0126 (02)(0,	1137813/61) =	= 2.63 15/min
0.	(1835 ds.fm)(0.1743 02)(0.1	0827 %的	= 26.42 15/m
. Nz	(1833 duff)	0.8135 Nr)(O.	(1) 18 04 200.	107.89 11/2.
Hi2O	× = 1833+ ×	, 0 023		
	x = (7)(m3000,E0	sy ⁸ /sif) =	3,40 15/min
	Total	Crit MASS t		140,34 11/2

Leakage Estimate

140,34 1/2 - 124 80 1/2 = 112

Lenkinse Volume

140,34 - 124.80 = 15,54 15/2

HEET Le a LL

CLENT/OUBLECT USATHAMA			¹y.ɔ. no_	7000-00-24
Taux JeschiptionE	7 RUN #3	Heat Balance		M 20
PREPARED BY M.C.L.				YE DEVORE
MATH CHECK BY METHOD REV. BY			DEPT	
Heat	Balance Arrou	no Tet Cham	ben	
Heat	Lost by	Process Gas		į
$\mathcal{C}_{\mathcal{O}_{\mathbf{x}}}$	(200+2.63 15/min)((0,225 00 //25 X 10	31-482°F) =	4:63 GTa/m.
Ho	(25/+3.40 15/Am))(0,478 OT //3·F)(10	(31 - 482°F)	775 Bts/min
Na	(55.36 + (107.89	1-28(1554)) (.25 37/2	(101-42°F) = 13,774 sty

Q (32.03 + (26.72-,21 (15.37)) (.22 500/16 5) (1031-426 50)

Total Heat Lost

17,081 514/2

Heat Absorbed by Leak AIR

(15.54 15/min) (0.24 50/13.F) (482-70°F) = 1,57 50/16.

Heat Lost Through Walls

(17,031 574/min) - (1537 574/min) = 15,544 574/min 932,664 BTH /Set 3

RFW 10-05-003/A-5/8

/Lieur/Subjet [ABK DESCRIP]	ct <u>Usatham</u> fich <u>Test Ro</u> s	, 辛3 円。	at Balance		1800-00-24
YE DARKSERY	M. Comos	DEPT_18//_	DATE RISED	39 AF	YE CEVORE
	YY			DEPT	ZTAD
	Avenage	Fuel GA.	s President	6,58 psig	
	Avenage	T.O. ex	it Gas		
		1787 10,700 6,47 10,83 82,70	A	/ / /	
	(102 (2000 IsAm)(.0647 002)	(.113785/s.f) =	14.72 15/min
•	O ₂ (2	low distal	(0,1083 Oc)(.0827 Wiff)=	17.92 15/min
	N2 (2000 de cfa)	(0,8270 ML)(الهائرة والمعرود ور	119,7515/m,
	<i>}4.0</i>	X + 0000 + X	= 100		
		x = (2	24 Am)(,0465	14.13 . 18	D.42 15/min

Panaph = (1.103)(6.58 ps:g)

= 7.25 psig = 4.3 mm BTu/hn

CLEAT/SUBJECT 1152T YAMA TASK DESCRIPTION Test River to Hart Calquee PREPARED BY M. Cosmos BERT 1811 BAYE 2/50089 (4,800,000 min sta/hr)/(23/6 37/6/) = 2073 5dfg. (34,5 scfm) (0,1196 5/scf) = 4,13 15/m. Am In leather 1628 18/00 - (140,313/0_+45/313) - 18,37 1/am Combustion Products from propose Ca (4.13 15/min) (2.49 15/15) = 12.25 15/min 4:0 (4.0 3/mm)(1.63 14/15) = 6.73 3/mm Ne (4.13 13/am)(12.07 13/6) = 49.85 13/mm Am Conserved (4.13 //min) (15.69 1/min) = 64.80 1/min Air Mars Balance Check 14.72 1/2 - (12.35/3/24 + 2.63) = -1,7 % H20 10.42 13/n - (6.73 1/2 + 7.40) = 2,8%

119.75 - (107.89 1/2- +,79(18.77)) = 2,2?

1/3

CLIENT/SUBJECT _	USATH	wn A			W.O. NO 7000 - 00-24
					TASK NO.
PREPARED BY _/??	· Cosmas	DEPT_	1811	DATE 215,89	APPROVED BY
				5A7E	
METHOD REV. BY		_ DEPT_		DATE	CEPT DATE

 $O_{1} = \frac{(17.72)^{15}/_{12}}{17.92)^{15}/_{12}} = \frac{(2442 + 21(837) - 21(9439))}{17.92)^{15}/_{12}} = 7.02$

Hoat Balance Chack

Heat relemed by Fue!

(4.13 13/m2 × 19,944 GTM/s) = 82,369 BTM/mm

Heat Absumbed by F.C. exit gases

COL (263 9/min) (0.225 1/2 1/2) (1787-48247) = 772 070/min

HO (3.40 13/m.) (0.47807/13) (087-482F) = 2/2/ 37/m.

No (107.9 1/2) (0,25 6-1/3) (1787 - 481 F) = 35,202 01/2

 O_{2} $(26.1/2 - 21(61.60))(.22 \frac{67/37}{127})(.787.4927) = 3,678 <math>\frac{370}{120}$ $(12.31 \frac{11}{120})$

Hent Associated by Combistion Products

(02 (12.35 13/n) (0.225 ora/sor) (1787-)0) = 4,771 ora

Had (1.63 13/n) (.478 ora/sor) (1787-70) = 1,338 ora

6,109 ora/n

Hent Assonbed by Lenk Am

For (1837 15/2) (0,24 my 4) (1787-70) = 7,570 soul/2

}



		SHEET A M. 11
CLEAT/SUBJECT . USATHAMA		W.O. NO 7-00-00-24
TAUL TEST MONTHINGERS XEAT	-3 Heat Balance	TASX NO
PREPARED SY M.C. MOL DEPT		
TREE MATH CHECK BY DEPT		
METHOD REV. BY DEPT	DAYE	DEPT DATE

Porlintion Losses

Surface AREA

Tr(5ft)(20ft) = 3/4 Al2

Heat Lost

(3/4 At) (2.8 0m/h, A) (5) (300 F-70 F) (1/6, n...) = 3,372 57%,
Total Losses

(41,773en/m + 6,109 - 7570+3,372) = 58,824 Bra/mm

Closure Balance

(82,369 - 58,824) = 28.6%

MEW 10-195-000/A-5/85

SHEET / of //

CLEWY/CURECT USATHAMA	W.O. NO 7000-00-24
TASK DESCRIPTION Test Russ #3 Heat Balance	
PREPARED BY 171. Comos DEPT 1811 DATE SO 89	APPROVED BY
MATH CHECK BY DEPT DATE	
METHOD REV. BY DEPT DATE	DEFT DATE

Gas Valouty IN AIN Proheaton

(18")(#Vizinch) = 1.5 ft

Try (15ft)2 = 1.767 ft2

(5533 Acfm)/1.767ft2 = 3131 fpm

Gas Velocity IN After Burner

17/4 (5ft) = 19,63 ft = 545 fpm

(10,700 Acfm)/19.63 ft = 545 fpm

1. Assuming same size

5523 Acfm / 545 Fpm = 10 H²

10 H² = ($\frac{1}{2}$ /4)(xH)²

x = 3.5 H Ø



Coeschiption	RUN #5 H	eat Balance	TACI	OK
PARED BY M. Colmos				HOVED JY
TH CHECK BY	DEPT	3T&C		
THOO REV. 3Y	DEPT	BATE	DEPT	DATE
Air			, as more and a second .	
INLET		Flash		
		Cham		
Fuel		工人		
Inlet				
and any angular constitution of the state of	- antiquestra prise a manuer e manquest mon sem a	ere e e e e e e e e e e e e e e e e e e	- A. W. A	
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Augna.	. T. I. + A	in Flow Pi	1202. /.// a	. lla inime
=	Annual media and an extra 1.3		The second of th	
Avenas	· Gas Pro	25 مرد	-31C 247	± ,61 05/4
a company and a company of the compa	the same of the sa		r er er er i gan i sir ir	
Avenage	Flash Ch	ambor Inlet		a constant and an area.
				eren gerieden in heen voorde en biede.
The second secon	/533	duction ± 3	3%	
6	736			
	4700	nc fm		
	1.9			
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	3,0	2 H20		í
ander-vidajaanspravis-jog-provingen dirakenjiligaagi edilah tigaanfilikkon var tan	the contract of the same of th		بنوید - بنوید میپ متبین برماد.	the same and the same and a residence of the same of t
and the existing and the contract of the contr			antan ini anta mata a anta a a a a a a a a a a a a a a a	gy and games annually approximate which in any property of the state o
CO.		5(0,019)(113714742	3.31 15/2.
	(1533 dscfm)(0019)(
	(1533 dscfm			
٥٤	(1533 decfm)(910.0)(.)(910.)(0827515/41)	= 21, 44 15/
	(1533 decfm)(0019)(0827515/41)	
0 z 	(1533 decfm) (910.0) (.) (931.0.) (570.) (518.)	0827515/41)	= 21, 44 15/
٥٤	(1533 dscfm (1533 dscfm (1533 dscfm))(910.0)(.)(910.)(0827515/41)	= 21, 44 15/
0 z 	(1533 decfm) (910.0) (.) (931.0.) (570.) (518.)	0827515/41)	= 21, 44 15/
0 z 	(1533 dscfm (1533 dscfm (1533 dscfm) x 1533+x)(0.019)(.0)(.0)(.0)(.0)(.0)(.0)(.0)(.0)20	(א ^{ילי} פרגזס (יאילי פאי	= 21, 44 15/min
0 z 	(1533 dscfm (1533 dscfm (1533 dscfm))(0.019)(.0)(.0)(.0)(.0)(.0)(.0)(.0)(.0)20	0827515/41)	= 21, 44 15/
0 z 	(1533 dscfm (1533 dscfm (1533 dscfm) x 1533+x)(0.019)(.0)(.0)(.0)(.0)(.0)(.0)(.0)(.0)20	(א ^{ילי} פרגזס (יאילי פאי	= 21, 44 15/min

MRIEN.

ent/subject <u>USA</u>	THAMA		W.O. NO	3HEST → M. 2000 - 00:
		Heat Balance		x 3102
) DATE /C F. 5 96	.42	PROVED 3Y
TH CHECK BY			_	
THOO REV. BY	DEPT	2775	TEPT	DATE
Come	ction to GA	s Flow for Alt	itude	
	onaection = c	21602000000	(4520 Ft))	= 1,176
	les/5~ /ve. = .	2350250000	(1750A))= /.066
the control of the control of	density natho	1.176 /1.066	= 1.10	3
ر ند و ندورنسا د مساست د مساست	• • • • • •	Density natio) (F		
etterio majapinangar-alaba, cemana sugar are		1.103 (2.47 psig)		
The complete of the complete date is compared to the complete of the complete		1,203 (x. 77 ps/3)		# 14
	A CONTRACTOR OF THE CONTRACTOR	2.72 939		e naturalista de la compansión de la compansión de la compansión de la compansión de la compansión de la compa
designation of miner and manufacture of contract	From vendos	graph 802	ع و.72 ps.5 ع	2.0 min
	(2,000,000	5 5 Tu/ha) / 2316 OTU	/cf 2	
	a commence of the state of the	863 scth = 14.	39 scm	of PropAn
	(14.39.	scfm) (0,1196 5/scf) = 1,72	15/10/10
Com 5	astion Ain	1. Α/οω		
	1-10w = 1	433 + 406 (L (((درسرا ا. ا	= 1475 50
ame - additions - return - return o' mine (filligene return)	11450 scm)(.075 15/sef)=	102.7 5/	1/20
			*	į
	mouth	landing under w	east obs	nucl
	moistyne Conditions			owed



1100	itu ama	•	W.O. NO DOCO	-00-24
LENT/300ECT 1/2/A	1100 miles	THEST BALANCE	W.D. NO NO_X	
ASX CESCRIPTION	Mal 12.11	DATE 1/2 Fe 690		
Repared by Inclined		DATE DATE	. APPROVEL	31
ethod rev. 37			DEFT	A i
	- /			
	comum water	LUNG		
·	100 mis/	5 . 3 Hz . / . 2 \ -	4	
· · · · · · · · · · · · · · · · · · ·	108. 1. 1/min Il .	01 3 Ho /15 da) =		<i>0</i>
		~ / L		
	ess Balance.	Check		
	115 00 15/	- (1.72 b/20 501	* 16. 3/5/ * 1	ne 15/ \"
	117,08 /20			08 /2.
•		117,08 15/2	110	
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	Mannan of	FILIPANE		····
		99 15/15545		
		63 15/16 Sas	man .	
and place to the same are now complete.	N2 12	00 15/16 SAC	and the second s	. one mining an elementar of many
• • • • • • • •	Total 16	69 15/15 545 - 15	say = 156	ban T
				19~
C	on bustion of	Fuel		·
		· · · · · · · · · · · · · · · · · · ·	ayara Manasa ant-aye-≀t s s is abb	
to the same control of the	CO. (1.72 1/m)	2.99 15/15)		5,14 13/min
11-27 - 25 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	1+20 (1.72 "/mi	2.99 15/15) -)(1.63 15/15) + 1.0	8 15/min =	3.88 13/m.
	N. (1.72 15/m)	(12.07 15/16)		20,76 13/11
			kanada ka a ak . s w k	
E	rcess Ain	and a second second second second second second second second second second second second second second second	- Andrews	e descende i v de
The second control of the second second second	عسد والرواعة بشدا بده	A		المندرين بالمعتدد
ennes - une a interdirente - a ministraturar en en establische	(108.7 15/MIL) - (1.72 5/100)(15	.69'3/6) = 81	21 1/00
The second secon	l 		<u> </u>	s Ain_
deligence and the control of the con				مستنبيد سرار مستند
	02 1- XS AIR	- (31.7:13/min)(121) - 17	,16 13/min
والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع وا	egaggag y an dag i were only som	er en ental Pellemont information of the contract of the contr	a territoria constituti de la constitución de la constitución de la constitución de la constitución de la const	
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(AMARIA AN ANTA A A FAMIL	•			

MIGHEN.

CLENT/SUBJECT USATHAMA TAIX DESCRIPTION Test Row T-5 Hest Balance PARPARED BY M. COSMOS DEPT. 1811 DATE 16 FOLGO Heat Balance . Heat Palensed by Frel (1.72 15/min) (19,944 ATU/15) = 34,303 13TU/mn Heat Absorbed by Combustium Products CO. (5.14 "/min) (0.225 am/15.F) (936 F-70) - 1002 == H20 (3.85 13/min) (0.478 BTV/15.7) (936-70°F) = 1,606 37 N2 (20.76 3/min) (0.25 and /6.F) (936-20.F) = 4495 are XS AIN (81,71 15/min) (0,24 50/1.F) (936-70 F) = 16,983 75 24,086 arch Radiation Losses 17 (20 mehrs) (12 mehr) (6.5 At + 24.5 At) = 162 At (162 At 2) (2: and At F) (300-70 F) (= 1742 = 1742 Heat Balance Companisin (34,303 (310/min) - (24,086 0m/min + 1742) = 24,7% 37,303 SM/mie

FW 10-05-003/A-6/85



CLENTIQUE OF USATHAMA TASK DESCRIPTION Test ROW T-5 Heat BALANCE 1711 DATE 16 Feb 90 PREPARED BY M, COSMOS MEPT APPROVED BY Average Flash Chamber Outlet dsifm = 5% 2033 17.72 80.97. H2 0 CO2 (2033 dscfm) (.015 COL) (0.11378 1/cF) . 3.47 1/m. 02 (2033 dscfm)(.17) 02)(0.082) 15/cf) = 29.76 15/min Ne (2033 decfm) (.809 Ne) (.072 15/cf) = 118.42 15/m x = (60.71 scfm) (.04654 15/scf) = 2.83 15/m. Total Brit GAS MAN Flow 154, 48 1/2. - eakage Estimate 154,48 5/min - 117.08 15/min 15 4. 48 15/min 154, 48 3/min - 117.08 3/min



SHEET 6 M / 1

		at Balance	TASK NO.	<u> </u>
PARED SY M. Cosmos	CEPT	DATE 16 Feb 90	VOR951	ED 3Y
H CHECK BY	DEPT	DATE	_	
Hod Rev. By	DEPT	DATE)EPT	DATE
		enterente en um en		
		, -, /	n1 1	
Heat L	SALANCE. How	uncl i=lash	Chamber	
Heat L	ost by thec	ess Gas.		
•	·			
(0,	$(\frac{3\cdot 314\cdot 374}{2})(c$	225 STY/15.F) (9	176 - 456°F) =	366 %
11.0	(2.21-2.13)	0. 475 ath/16 of)(9	3(-47.5)	= 578 4
	190,12 + (114.42	(0,25 are) (0,25 are)	/V a\	
Nz	2) (0.25 /4	华人 136-456 下)	= 10,790
a san real membership and a second	7:21.444 (2976)	21(37.4)]	<u>. </u>	
U2		· ((4.71)) ((2.41)	<i>"%=</i>)(936-452)	* 2,497
te to make the control of the control				
Total	Heat Lost	by Gas	= ,	14, 1819
	•	;	•	
Hrat	Abjunbel	by Leoh Ain		
	5 4 15/2	024 574/13-15)(4	17-70 F) :	3465
()		~ ~ ? . //3 / J(. !	/36 / / /	3/8 J
(3				
	Lost Theory			. m bags
Hest	Lost Theory	h WAlk		
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Hest	Lost Theory	h WAlk	- 10	
Hest	Lost Theory	h WAlk	- 10	

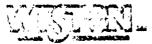


	THAMA	Hart Rolland		7000-00-24
	+ lev T-5	DATE 24 Feb 90		X NO
			an idir	PROVED BY
	DEPT	DATE	DE07	5 A 7 E
OD REV. 3Y	DEPT	JAIE	_ CEPT	DATE
entantinus aus seus appartes es au sau s	ige Fuel Gas	Pressure G.	26 ps, t	,59
	2467 d	er dage g all ann ente sager an see decadement a		
THE PERMITTER AND ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER AND ADDRESS OF THE PERMITTER AND ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER ADDRESS OF THE PERMITTER	1706	· •		rentage – retaining, amang generalism date – inceremblish da
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173	1 7 11 / 7 11		~~~! I I \	➡ ノコ ハ ~/a :
)(,,108 OL)(,092)(,929 NL)(,072		
N2	(2467 dscfm)		146 3/J.()	
N2	(240) dscfm)(.829 N.)(.07:	176 ³ /151)	2 148, 1 ¹³ /m.
N2	(240) dscfm)(.829 N.)(.073	176 ³ /151)	2 148, 1 ¹³ /m.
N2	(240) dscfm)(.829 N.)(.073	176 ³ /151)	2 148, 1 13/m.
N2	(246) dscfm. 246) x X = ()(.829 N.)(.073	176 3/Jul)	2 148, 1 13/m.
N2	(246) dscfm 2467 + V × 2 (=	226 cfm)(.0765	176 3/Jul)	2 148, 1 ¹³ /m 2 10,53 ¹³ /m
N2	(246) dscfm 2467 + V × 2 (=	226 cfm)(.0765	4 3/2.b)	2 148, 1 ¹³ /m 2 10,53 ¹³ /m

CLIENT/SUBJECT <u>() }</u> TAGK DESCRIPTION <u>T</u>		447 B.12.	<u> w.o. No7660 - с</u>	· O
PREPARED BY			/ 5	
MATH CHECK BY			5 75 APPROVED 3Y	
AETHOD REV. 3Y			DATE.	*
The state of the s			JA16.	
e mana and a mana a mana			/sd) = 1943 scfs = 32.4 scfm	
	12.4 scfm)(0.	1196 3/scf] =	3,87 4/11/2	
**************************************	Leahase			
to the second of the control of the				
	198,3 B/m.	(154.5 ¹³ /n	= 37.9 = 20.1	
Cum	Sustion Pro	ducts		
Co	2 (3.8) 15/1	~) (2,99 13/16)) = 11.57 15/mm	•
He	0 (2.85 %)(1.63 4/15) = 6.31 18/mm	
			46.71 min	هم خيت
Ain	Cornsum ed	(3.6) 3/2/2)	15,69 3/16) = 60.72	- روز الحا
	s Balance c			
	• • •			
H=0	20 53 5/m	(6.31 15/m _10.53 15/m	114 + 2.53 1/2) - 13.	22.
		(112.72 ¹⁵ /.	4.79 (39 = 1/2)	./.2



ENVAUNCE USATHAMA TASK DESCRIPTION Test Run #5 Hest Balance PREPARED BY M. Cosmos DEPT 1811 DAYE 24 Feb 90 22,0 13/mm - (29.76 1/mm + ,21 (39.5 1/mm) -. 21 (60.70 1/m.) Hent Balance Check Heat alrased by Fuel (3.87 13/min) (19,994 874/13) = 77,378 BT4/12/10 Heat Absented by F.C. Exit Gales COL (347 1/mis) (0.225 OTU/15°F) (1706-456°F) - 976 2 H20 (2.83 1/10) (0.478 67/13 0F) (1706-4565) = 1691 = (118.42 1/mi) (0.25 07/15 %=) (1706-456 F) = 37,006 N2 (29.75 1/20 -, 21 (60.72)) (0.22 5TU/8 -F) (176-356F)= 4677 44, 350 Heat Absumbed by Combustion Products (Oz (11.57 15/mix) (0.225 atu/154F) (1706-456F) = 3254 = H.O (6.31 3/2) (0.478 874/4.F) (1706-45% F) = 3770 = Hest BALANCE (39.16/min) (3.24 54/15 F) (1706-70 F) - 15.666 3



PREPARED BY M. C. J. MUS. DEPT. 1814 DATE 24 F3 L. 90 APPROVED IN Radiation Losses Surface AREA M(5H) (20ft) = 3/4 AL (314 ft2)(218 514/6 A2 =) (300-70) (Mama) = 3370 07 /2 Total Heat Losses (44, 350 574/2 + 7024 + 15, 466 + 3574) = 70,415 Closure Baltice 27,183 BTK/inim



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METHOD REV. BY	DEPT	DATE	DEPT	DATE
Cal	culated. He	At. Losses	from chan	nber Test 3
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	SATHAMA	/	W.O. N	<u> 7000 - 00</u>
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	<u>u.</u>	= 1.82	BTU /h. 44"	°F
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	• DU	125+219/2	245 AL	
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CLEMIT/BURNECT US ATHAMA				WO NO 7000-00-27				
TASK DESCRIPTION	tion Cole	ulation		TASK NO				
PREPARED BY M. Cosmos		1811 DATE 24 Feb 90			APPROVED BY			
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CLIENT/SUBJECT <u>USATHAM A</u>						W.O. NO. 7000-00-27				
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CLENT/SUBJECT USATHAMA TASK DESCRIPTION Town Later Calculations TASK NO. DATE 24 F-690 REPARED BY M. COJMOS DEPT 1841 APPROVED BY DEPT ETHOD REV. BY TeA T-2 Gas Velocity in Chambon (4400 works + 3917 works)/2 . 4159 works Ann - TO'/4 = Tr(12,54) 4= 123 H' reloc, ty = 4159/12342 = 33.9 fpm Test T-3 (5532 worfm + 3700 worfm)/c = 4717 worfm roclosity = 4717 wafm / 123 Az = 383 fam Test T-5 4700 worfm + 4133 worfm) /2 = 1/4/7 worfm Nelverty = 4417 warfan / 123 M2 = 35.9 fpm